Draft

Program Environmental Impact Report

SCH # 2010092023

Road and Trail Change-In-Use Evaluation Process

California State Parks

October 2012

Appendices

Draft Program Environmental Impact Report
for the
Road and Trail Change-in-Use Evaluation Process

SCH No. 2010092023

Prepared by

California State Parks

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October 5, 2012

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Appendix A

Notice of Preparation, September 16, 2010

SCH # 2010092023

State of California
The Resources Agency
California Department of Parks and Recreation

REVISED NOTICE OF PREPARATION

Date: September 16, 2010

PROJECT TITLE: **Road and Trail Change-In-Use Evaluation Process**
Program Environmental Impact Report
State Clearinghouse Number 2010092023

This Notice of Preparation (NOP) revises and supersedes the previously released NOP dated September 8, 2010 for the Road and Trail Change-in-Use Program Environmental Impact Report (EIR). The revisions are related to a changes in the name of the program, date of one scoping meeting, and due date for public comments about the scope of environmental issues in the Program EIR.

INTRODUCTION AND OBJECTIVES:
The California Department of Parks and Recreation (California State Parks) proposes to implement the Road and Trail Change-In-Use Evaluation Process (Program) to facilitate the review of proposals to add or change uses of existing recreational roads and trails in the State Park System. The Program is intended to facilitate consideration of changes in non-motorized uses of existing State Park roads and trails to best accommodate accessibility and recreational activities that are appropriate for each road or trail facility. The Program seeks to provide California State Parks with an objective process and evaluation tool to assess proposals to modify roads and trails to add or remove recreational uses.

A Program EIR is being prepared to evaluate the potential environmental effects of the proposed Program. The Program EIR is being prepared in compliance with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines.

California State Parks is the Lead Agency for the Program, as defined by CEQA. The project description, location, and possible environmental effects are included with this notice. We are now seeking input from agencies, organizations and the public to further define the project, develop alternatives, and discuss potential environmental impacts and mitigations.

CALIFORNIA STATE PARKS CONTACT PERSON FOR QUESTIONS ABOUT THE PROGRAM:
Gary Waldron, Environmental Program Manager
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
Telephone: (916) 445-8772
Email: gwald@parks.ca.gov

SEND COMMENTS ON THE SCOPE OF THE PROGRAM EIR TO:
Heidi West, Environmental Coordinator
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
Fax: (916) 445-8883
Email: ceqansc@parks.ca.gov (Subject Line: Change In Use)

Due to time limits mandated by State law, please submit comments to the Contact below **no later than November 30, 2010.** Include the full name, telephone number with area code, and email address of a contact person for your agency or organization with each submittal.

PUBLIC SCOPING MEETINGS:
Affected agencies, organizations, and the public are invited to scoping meetings to be held at the following dates, times, and places. These scoping meetings also meet the requirements in Section 15082(c) of the State CEQA Guidelines.

Saturday, September 25, 2010
1:00 to 4:00 pm open house
Program presentation at 2:00 pm
Candlestick Point State Recreation Area
1150 Carroll Avenue
San Francisco, CA 94124

Saturday, November 13, 2010
1:00 to 4:00 pm open house
Program presentation at 2:00 pm
Lake Activities Building
Lake Perris State Recreation Area
17801 Lake Perris Drive
Perris, CA 92571

PROJECT DESCRIPTION:
This Program applies to decisions that are made for the addition or removal of different types of non-motorized uses of a State Park System road or trail. These types of use may include: pedestrian, accessible pedestrian, wheelchair, equestrian, mountain bike, road bike, in-line skating, or other unidentified non-motorized uses not currently recognized as potential road and trail use types.

Potential project actions that may result from recommendations for a change-in-use type include: reconstruction or rehabilitation of an existing road or trail prism; installation of speed control or separation devices to protect different user types; minor rerouting of trail alignments to correct otherwise unsustainable road and trail grades, or to resolve an existing environmental problem; installation of hardened surfaces, such as, but not limited to, aggregate surfacing, rock armoring, wooden boardwalks or puncheons and bridging; closure, decommissioning, and restoration of existing roads and trails; conversion of roads to trails; and trailhead, point of access, and parking improvements related to changes in recreational road or trail use.

In general, project actions that are eligible for coverage by the program would involve modifications within the corridor of an existing road or trail. Construction would be limited to the existing disturbed area of the road or trail and adjacent lands.

Any proposed project actions that are taken with regard to trails and roads qualifying for change-in-use as a result of the application of the proposed Trail Use Change Process will be required to meet Standard Project Requirements (i.e., environmental protection features) established for trail projects with the objective of making them as "self-mitigating" as feasible. These Standard Project Requirements have been developed to protect resources and avoid impacts to cultural and natural values that may be affected by any of the trails project actions. The complete list of Standard Project Requirements for trails will be included in the Program EIR.

Standard Project Requirements include measures to avoid and minimize environmental effects that are incorporated into the design of a trail project. The requirements can be defined as a result of detailed testing, inventories, studies, and documentation that performed before any surface disturbing activity occur as part of the road or trail modifications approved through the change-in-use process. They also include project construction activities that must be used, such as vegetative removal strategies, dust and erosion abatement techniques, seasonal and soil moisture restrictions for construction, and appropriate resource avoidance methods. The Standard Project Requirements also set inspection and maintenance standards for construction activities on trails to avoid environmental problems associated with earthquake damage, flooding, spill prevention, and storm water pollution prevention.

PROJECT LOCATION:
The Road and Trail Change-in-Use Evaluation Process could be applied to roads and trails in all state parks, state recreation areas, and state beaches of the California State Park System that are owned and managed by the state. The analysis will be organized in the context of the 10 bioregions established by the California Biodiversity Council in order to characterize environmental effects of road and trail change-in-use proposals in the relevant context of different ecosystems.

PROBABLE ENVIRONMENTAL EFFECTS:
The Program EIR will identify and describe the potential environmental effects associated with implementing the Road and Trail Change-in-Use Evaluation Process. Mitigation measures will be identified that may reduce or eliminate potentially significant and significant effects. The following environmental topic areas may be affected by the proposed program, which will be addressed in the Program EIR:

Terrestrial Biological Resources
Aquatic Biological Resources
Geology, Soils and Minerals
Hydrology, Water Quality, and Erosion/Sedimentation
Cultural Resources
Hazards and Hazardous Materials
Aesthetics and Views
Transportation
Greenhouse Gas/Climate Change/Energy Resources
Air Quality
Noise
Public Services and Utilities

INTENDED USES OF THE PROGRAM EIR:
The Road and Trail Change-in-Use Evaluation Process EIR is a Program EIR under Section 15168 of the State CEQA Guidelines. Later activities that are consistent with the program evaluated in this EIR can

benefit from streamlining of the CEQA process. As new site-specific actions are proposed in park units under this program, California State Parks will use a checklist to document the evaluation of the site and the actions proposed to determine whether the environmental effects are covered in this Program EIR. If the evaluation process confirms that no new effects would occur and that no additional mitigation measures would be necessary, California State Parks can approve the actions as being within the scope of the Program EIR, and no new environmental document would be required. If additional significant impacts not addressed in this Program EIR are identified, they will be evaluated in later, project-specific CEQA documentation, in accordance with the State CEQA Guidelines.

Appendix B

Program EIR Scoping Report, Volumes I and II, March 18, 2011

Scoping Report

Road and Trail Change-In-Use Evaluation Process Program Environmental Impact Report Volume 1

PREPARED FOR:

California Department of Parks and Recreation
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814

March 18, 2011

Scoping Report

Road and Trail Change-In-Use Evaluation Process Program Environmental Impact Report

Prepared for:

California Department of Parks and Recreation
Northern Service Center
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Sacramento, California 95814

Contact:

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March 18, 2011

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1 INTRODUCTION

The California Department of Parks and Recreation (California State Parks) proposes to implement the Road and Trail Change-in-Use Evaluation Process (Program) to facilitate the review of proposals to add or change uses of existing recreational roads and trails in the State Park System. The Program is intended to facilitate consideration of changes in non-motorized uses of existing State Park roads and trails to best accommodate accessibility and recreational activities that are appropriate for each facility. The Program seeks to provide California State Parks with an objective process and evaluation tool to assess proposals to modify roads and trails to add or remove recreational uses.

A Program Environmental Impact Report (PEIR) is being prepared to evaluate the potential environmental effects of the proposed Program. The PEIR is being prepared in compliance with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines to enable the use of the provisions of Section 15168 of the State CEQA Guidelines to streamline the environmental review of later projects that are consistent with the Program.

California State Parks is the Lead Agency for the Program. A Notice of Preparation was circulated on September 15, 2010 by the Lead Agency to seek input from agencies, organizations and the public to further define the project, develop alternatives, and discuss potential environmental impacts and mitigation measures that should be included in the PEIR. A brief description of the proposed project and the organization and intended use of this scoping report are provided below.

1.1 SUMMARY OF PROPOSED PROJECT AND INTENDED USE OF THE PEIR

This Program applies to decisions that are made for the addition or removal of different types of non-motorized uses and certain motorized accessibility vehicle uses of a State Park System road or trail. These types of use may include: pedestrian, accessible pedestrian, wheelchair, equestrian, mountain bike, road bike, in-line skating, motorized accessibility vehicles that meet State Parks policy standards for enhancing access to designated trails, or other unidentified non-motorized uses not currently recognized as potential road and trail use types. State Parks' policy standards for use of motorized accessibility vehicles on recreational roads and trails will be presented in the PEIR.

Potential project actions that may result from recommendations for a change-in-use type include: reconstruction or rehabilitation of an existing road or trail prism; installation of speed control or separation devices to protect different user types; minor rerouting of trail alignments to correct otherwise unsustainable road and trail grades, or to resolve an existing environmental problem; installation of hardened surfaces, such as, but not limited to, aggregate surfacing, rock armoring, wooden boardwalks or puncheons and bridging; closure, decommissioning, and restoration of existing roads and trails; conversion of roads to trails; and trailhead, point of access, and parking improvements related to changes in recreational road or trail use.

In general, project actions that are eligible for coverage by the Program would involve modifications within the corridor of an existing road or trail. Construction would be limited to the existing disturbed area of the road or trail and adjacent lands.

Any proposed project actions that are taken with regard to trails and roads qualifying for change-in-use as a result of the application of the proposed Road and Trail Change-in-Use Evaluation Process will be required to meet Standard Project Requirements (i.e., environmental protection features) established for trail projects with the objective of making them as “self-mitigating” as feasible. These Standard Project Requirements have been developed to protect resources and avoid impacts to cultural and natural values that may be affected by any of the road and trail project actions. The complete list of Standard Project Requirements for trails will be included in the PEIR.

Standard Project Requirements include measures to avoid and minimize environmental effects that are incorporated into the design of a project. The requirements can be defined as a result of detailed testing, inventories, studies, and documentation that performed before any surface disturbing activity occur as part of the road or trail modifications approved through the change-in-use process. They also include project construction activities that must be used, such as vegetative removal strategies, dust and erosion abatement techniques, seasonal and soil moisture restrictions for construction, and appropriate resource avoidance methods. The Standard Project Requirements also set inspection and maintenance standards for construction activities on trails to avoid environmental problems associated with earthquake damage, flooding, spill prevention, and storm water pollution prevention.

The Road and Trail Change-in-Use Evaluation Process could be applied to roads and trails in all state parks, state recreation areas, and state beaches of the California State Park System that are owned and/or managed by the state. The analysis will be organized in the context of regionally defined environmental conditions (e.g., soils, habitats) to characterize environmental effects of road and trail change-in-use proposals in the relevant context of different ecosystems and regions. The specific organizing approach will be established in the early stages of PEIR preparation.

The Road and Trail Change-in-Use Evaluation Process EIR is a Program EIR under Section 15168 of the State CEQA Guidelines. Later activities that are consistent with the program evaluated in this EIR can benefit from streamlining of the CEQA process. Because new site-specific actions are proposed in park units under this Program, District personnel of California State Parks will use a checklist to document the evaluation of the site and the actions proposed to determine whether the environmental effects are covered in this PEIR. If the evaluation process confirms that no new effects would occur and that no additional mitigation measures would be necessary, California State Parks can approve the actions as being within the scope of the PEIR, and no new environmental document would be required. If additional significant impacts not addressed in this PEIR are identified, they will be evaluated in later, project-specific CEQA documentation, in accordance with the State CEQA Guidelines.

1.2 ORGANIZATION AND INTENDED USE OF THIS SCOPING REPORT

This scoping report is organized into chapters, as identified and briefly described below.

Chapter 1, “Introduction”: Chapter 1 summarizes the proposed project and describes the organization and intended use of this scoping report.

Chapter 2, “NOP Comments”: Chapter 2 provides review and assessment of NOP comments and recommendations for incorporation of comments into the PEIR.

Chapter 3, “Program EIR Preparation Guidance”: Chapter 3 describes information needed to complete the PEIR sections, a list of studies needed to support the PEIR, anticipated schedule for the PEIR, and outline and summary of sections/topics to be addressed in the PEIR.

Chapter 4, "References and Attachments Provided in NOP Comment Letters": Chapter 4 contains a compiled list of references and attachments that were provided in NOP comment letters.

Appendices: The appendices contain the NOP (Appendix A), NOP comment letters (Appendix B), and other documentation used for preparation of the scoping report.

2 NOP COMMENTS AND TOPICS RECOMMENDED FOR THE PEIR

Public comments submitted during the Notice of Preparation (NOP) circulation period are summarized and assessed in this section of the Scoping Report. Also, the list of environmental issues to be included in the PEIR based on the scoping comments is described. Please note that the PEIR will address the full scope of environmental issues, so it will not be limited to the topics raised in the scoping process.

The following discussion provides a review and assessment of the environmental issues raised in comments on the NOP. Comments are related to specific letters by the letter number and page number (See Appendix B for numbered comment letters). The commentary is organized by topic. Where a response to a comment is appropriate to clarify how the PEIR will address a topic, it is presented in parentheses.

2.1 PROJECT DESCRIPTION

A commenter asks if mitigation monitoring or review of mitigation impacts related to proposed *Standard Project Requirements* will be conducted and whether the testing, studies, inventories, and documentation to be used in development of the Standard Project Requirements will be reviewed by the public (Letter O-5, page 2). (As stated in the NOP, the complete list of Standard Project Requirements will be included in the PEIR. Therefore, these Standards will be subject to environmental review. Monitoring approaches will also be explored in the PEIR.)

A commenter asks if the Program would impact or supersede other agency authority over land use within their jurisdiction (Letter 0-5, page 7). Interagency processes would need to be defined in the PEIR. Commenter suggests adoption of specific standards for determining the suitability for use by specific groups and for multi-use. Criteria should be established for determining when a trail is suitable for use by specific groups and for multi-use. Such criteria would include trail width, grade, sight lines and steepness of adjacent terrain (Letter I-7, page 1).

Some commenters state that there is inequity in the number of miles of trails allocated and ratio of trail users to various user groups (Letter O-9, page 3; Letter O-11, page 1; Letter O-1, page 1).

2.1.1 TRAIL USE CHANGE SURVEY AND PROGRAM CHECKLIST

Several commenters offered suggestions about how to improve the survey checklist or questions about the appropriate use of the survey. A commenter asks if the Program checklist will be made available for public review during the PEIR process (Letter O-5, page 4).

The Bay Area Ridge Trail Council recommends some additions to the draft Trail Use Change survey evaluation criteria list: #2) Compatibility: add "Is the trail part of a regional trail route that supports additional uses in other jurisdictions?"; and #3) Effects to Circulation Patterns: add "Does the change close a "use gap" in a longer, regional trail?" (Letter O-10, page 3).

The Marin Conservation League recommends that State Parks should not rely solely on the current trail use change survey procedure for CEQA-compliant review of an individual project because it does not provide the analytical support for identifying potentially significant impacts or specific mitigation to reduce impacts to less than significant As an example, the commenter states that for the Bill's Trail project, the survey failed to identify its location within designated critical habitat (Letter O-13, page 2).

One commenter states that The Trail Use Change Survey refers to evidence of "unauthorized trail use", Section 2.4. , and it is not clear how this information will be used and interpreted. Commenter states that there can be many reasons for unauthorized trail use by mountain bikers, including cyclists being arbitrarily excluded from trails, failure to provide desired trails, or the need for more legitimate trail access. In most cases, unauthorized trail use will not be diminished unless the root causes are identified and dealt with in a constructive manner (Letter O-9, page 3).

2.1.2 DESCRIPTION OF PROJECTS ELIGIBLE FOR THE CHANGE-IN-USE PROCESS

A number of commenters ask how projects would be evaluated under the PEIR and request that Program methodology and its limitations be described in detail.

A commenter asks if there will be a maximum distance within which a change to adjacent lands can be made under the Program, specifically as it relates to minor rerouting under the Program (Letter O-5, page 2). (The PEIR will define parameters and guidance under the Program for any proposed actions taken on adjacent lands within a trail corridor.)

Based on an observation that the bioregions are not intended to provide homogeneous policies throughout their individual reaches, the commenter suggests that the PEIR project description include a discussion of the limitations to organizing impacts and mitigation measures by the 10 bioregions (Letter O-5, page 3).

A commenter asks how uses appropriate for a road or trail are determined (Letter 0-5, page 1). (This process will be outlined in the PEIR.)

One commenter asks that CEQA exemptions be preserved for routine maintenance by providing clear differentiation between maintenance and major realignment or upgrade (Letter O-10, page 3).

Commenter states that the PEIR needs to make it very clear how specific projects will be evaluated and what the noticing requirements will be and how they will be implemented under the Program. Several commenters request that the noticing requirements be expanded beyond CEQA requirements (e.g., allow organizations and individuals to register with State Parks for e-notification of pending change-in-use projects) and State Parks website (Letter O-13, pages 2 and 3; Letter O-3, page 1; Letter O-4, page 1).

A commenter suggests that a comprehensive description of the overall action be provided with a glossary to support it. This could be portions of the State Park's "Trail Handbook" as an appendix that provides the types of trail and road modification needed for a change-in-use (Letter O-13, page 3).

2.2 ENVIRONMENTAL IMPACTS AND MITIGATION (GENERAL)

Several commenters made general suggestions on how to approach environmental impacts and mitigation in the PEIR.

A commenter requests that the PEIR either append a list of BMPs or otherwise incorporate them as specific mitigation measures (Letter O-13, page 4).

Commenter states that trail use changes themselves may mitigate certain impacts. For example, opening a trail for additional uses may allow for more visitors to have direct park access without the need for a vehicle (Letter O-10, page 3).

Commenter states that evaluation of environmental impacts of additional trail users, or the environmental impact of a allowing a different class of trail users should focus in part, on the per capita impact. For example, the document should discuss whether an individual mountain biker has a greater impact on the trail/environment than an individual hiker (Letter O-11, page 1). Some bicyclist organizations commented that the Program analysis should take into account the number of trail miles in a given park unit and whether they are proportionately allocated to users based upon the size of the user group (Letter O-9, page 3; Letter O-11, page 1; Letter O-1, page 1).

A commenter asks if the PEIR will address NEPA issues or processes for joint state and federal approvals (Letter 0-5, page 7).

More specific comments related to impacts and mitigation are grouped by resource area or topic below (Section 2.2 through 2.18 of this document).

One commenter asks how CEQA Guideline Section 15131 will be addressed in the Program or PEIR (i.e. will only environmental effects be assessed, or will it include social factors and public safety, or economic factors and ability to fund policing and management of trails (Letter O-5)). Although CEQA Guidelines Section 15131 states that 'economic or social effects of a project may be used to determine the significance of physical changes caused by the project', it is our opinion that a change-in-use of a State Park road or trail would not result in a social or economic impact that could lead to a finding of significance under CEQA (ex. divide an existing community), mainly because these roads and trails are located within established recreational areas instead of existing neighborhoods and communities.

2.3 AIR QUALITY

No substantive comments related to air quality were provided in the NOP comment letters.

2.4 GREENHOUSE GAS/CLIMATE CHANGE/ENERGY RESOURCES

A commenter asks to what extent the Program could increase greenhouse gases or otherwise promote climate change (Letter O-7, page 1). Another commenter refers to projected rises in sea-level and the need for planning associated with safety of fills and sea level rise. Commenter also states that the DEIR should discuss climate change impacts such as inundation and its impacts on other resources (i.e. biological resources, transportation, hydrology, water quality, hazards, cultural resources, utilities, and public services) and aim to address both mitigation and adaptive measures (Letter S-1, page 2).

2.5 TERRESTRIAL BIOLOGICAL RESOURCES

One commenter asks how the need for resilient habitat, given global warming, will be discussed in the PEIR (Letter I-10, page 1).

One commenter provides research related to potential trail and trail use impacts and management implications on vegetation and wildlife (Letter O-11, pages 2, 6, & 7).

A commenter lists examples of impacts to vegetation, wildlife, and habitat made by various user groups on trails (i.e. walkers, joggers, equestrians, and mountain bikers), varying in degree based on personal observation and anecdotal evidence(Letter O-13, pages 3 & 4):

- vegetation trampling and compaction of leaf litter and soil;
- soil loss through rutting and erosion, with consequent sedimentation of waterways;
- loss of both herbaceous and brittle woody plant species near trails;
- habitat disturbance and trail “widening” due to wandering off trail or cutting corners;
- habitat fragmentation (widening trail impedes movement and dispersal of animals that are reluctant to cross exposed openings);
- habitat disturbance from noise and the presence nad motion of users (e.g., decreased nesting near trails, altered bird species composition near trails, and increased predation of nests by animals using the trail as corridor);
- introduction of exotic and weedy species from foot traffic, bicycle tires, and horse manure (trails are natural conduits for movement of exotic species);
- nutrient enrichment from horse manure and urine that could favor invaoitno so fweedy species along horse trails; and
- direct loss off small or slow-moving wildlife such as small rodents and reptiles by rapid moving bicycles (“road kill”).

2.6 AQUATIC BIOLOGICAL RESOURCES

No substantive comments related to aquatic biological resources were provided in the NOP comment letters.

2.7 GEOLOGY, SOILS AND MINERALS

Potential impacts to geology and soils as a result of the Program that are referenced by some commenters include soil compaction, erosion, and loss of soil structure (Letter O-9, page 4; Letter O-2, page 2; Letter O-11, pages 3 through 5). Another commenter provides research related to potential trail and trail use soil impacts and management implications (Letter O-11, pages 3 through 5).

2.8 HYDROLOGY, WATER QUALITY, AND SEDIMENTATION

Some commenters state concern that opening trails to more trail user groups and users may create ruts in existing trails that could result in sedimentation to adjacent water bodies (Letter O-9, page 4; Letter O-2, page 2). Another commenter provides research related to potential trail and trail use impacts on water resources and management implications (Letter O-11, pages 3 through 5).

2.9 CULTURAL RESOURCES

No substantive comments related to cultural resources were provided in the NOP comment letters.

2.10 HAZARDS AND HAZARDOUS MATERIALS

Comments related to trail use safety are summarized in this section of the Scoping Report. No substantive comments were received related to other hazards or hazardous materials.

A commenter asks if, in addition to environmental protection features, the "Standard Project Requirements" will include safety provisions (Letter O-5, page 2).

Some commenters state concern that displacement of traditional trail users will occur due to safety concerns (i.e. mountain bike use is opened on hiking and/or equestrian use trails) (Letter O-6, page 1 & 2).One commenter provides a statement on safety considerations for multi-use trails from California Equestrian Trails and Land Coalition (CET&LC) and requests these recommendations be considered for inclusion in the Program requirements for all trails (Letter 0-5, Exhibit G).

CET&LC requests that if mountain bike use is to be added to any equestrian and/or hiking trail, mitigation must include speed limits, safety practices, and effective enforcement which would also serve the collateral benefit of preventing associated environmental damage (Letter 0-5, page 5). CET&LC requests that their safety guidelines be considered as a template in development of safety requirements to be included in the Program (Letter 0-5, Exhibit G). The commenter states that because these safety guidelines both provide for public safety and define mitigations which will reduce consequent and related environmental damage, these safety guidelines should be consistent with CEQA guidelines 15126.4(a)(2) as it relates to the full enforceability of mitigation measures. The commenter states that reckless mountain bikers are a significant safety problem for equestrian users and that there is a lack of enforcement of rules on trail use or formalized reporting and recording of incidents. The commenter recommends that the PEIR address these issues with mitigation measures (Letter 0-5, page 5).

The commenter also references CEQA Guideline 15126.2(a) and relates it to why the PEIR analysis should consider significant health and safety problems caused by a physical change (e.g., inclusion of bikes on a trail), impacts of bringing new users onto a trail (i.e. new users=more users), and scenic quality impacts (Letter 0-5, pages 5-6).

The commenter states that the speed and behavior of problem bikers have an indirect and cumulative effect, under CEQA, of damaging existing trails and parkland environments. Commenter also states that problem bikers create a threatening and frightening experience on the trail for other users instead of a relaxing and serene experience. The commenter then states that these are significant social and environmental effects as described in CEQA Guideline 15126.4 and 15126.2. The commenter states that mitigating for these issues is best accomplished by preventing the speed and behavior of problem bikers with enforced time, place, and manner of use restrictions, or not authorizing trail use for bikers on equestrian use trails under the no project alternative (Letter 0-5, page 6).

Another commenter states that the PEIR should spell out the road and trail performance standards that are necessary to ensure safety and minimize user conflicts (Letter 0-13, page 5).

With respect to potential trail safety and user conflict, potential trail measures were suggested by a commenter and are listed below (Letter I-11, page 1 &2):

1. Trail tread widening. This practice may enhance rides, but may increase damage and habitat fragmentation (Letter I-11, page 1 &2).

2. Riding up the up-hill slope to reduce or "shave" bike speed that results in increases environmental damage to the slope. Armoring the slope makes clear that secondary impacts follow from this practice. Speed differential between bicyclists and other trail users has been repeatedly reported by the public and members of the California Trails Committee as reflected in their publicly available meeting minutes. It is a key safety and resource impact. Speed also can cause environmental damage because bicycle

uses/users often occupy the center of the trail, travel in groups, and have difficulty staying on the trail tread when the trail steepness causes high speeds (Letter I-11, page 1 &2).

3. "Before-and -after" assessment. If a before-and-after assessment had been conducted on the Tapia Spur trail in Malibu, for example, it would have demonstrated displacement and serious safety issues to other uses arising from added mountain bike use (Letter I-11, page 1 &2).

4. Acceptance of user experience reports. In discussing user conflicts, the argument that official reports or scientific data are required to establish the existence of user conflict must be set aside. The environmental preparer should not ignore the written decision of Ninth Circuit Court of Appeals which held, in its finding in favor of the Defendant Babbitt, that:

   > "Individual comment is a very persuasive indicator of "user conflict," for determining the existence of conflicts between humans cannot be numerically calculated or counted; rather, the existence of conflict must be evaluated. The court can envision no better way to determine the existence of actual past or likely future conflict between two user groups than to hear from members of those groups." (Bicycle Trails Council of Marin v. Babbitt, 82F. 3d 1445, Court of Appeals, 9th Circuit, 1996) Emphasis added.

   The Court of Appeals accepted user experience as an indicator of conflict. State Parks is well positioned to follow the Court's opinion (Letter I-11, page 1 &2).

5. Minimum sight distance. Commenter states that a minimum sight distance threshold requirement is needed for trails that are narrow and/or have blind corners to ensure they are not opened to unsafe trail uses (Letter O-2, page 2). Another commenter references safety concerns associated with blind curves and switchbacks on narrow trails (Letter O-5, Exhibit G, Page 2).

6. Use of trail conflict research. Findings from research conducted by Jacob & Schreyer, Roger Moore, Jennifer Hoger & Deborah Chavez found that: 1) Conflicts can occur among different user groups, within the same user group, and due to factors unrelated to trail activity; 2) Conflict can be felt or perceived even when there is no actual contact between trail users; 3) Conflict can be seen as a difference between perceived "low impact" passive users and "high impact" aggressive users; 4) User conflict is a matter of perception and varies from person to person (Letter O-9, page 2).

7. Trail management techniques. Trail use conflicts can be reduced with trail management techniques such as 1) Information and education; 2) Signs; 3) Setting appropriate expectations for trail users; 4) Paid and volunteer trail patrols; 5) Peer education on proper trail behavior; 6) User involvement and partnerships; 7) Trail advocacy groups; 8) User group coalitions; 9) Volunteer trail work; 10) Shared-use events; and 11) Designing trails in a way that manages speed (Letter O-9, page 2).

8. Examples of measures that can be implemented to manage safety on trails include the following (Letter O-9, page 5 & 6):

   - Provide public education on proper trail etiquette
   - Provide trail yield instruction signs at all multi-use trailheads
   - Provide directional signage
   - Conduct multi-use trail workshops
   - Conduct horse desensitization sessions

- Work with bike shops, schools, clubs, and outdoor stores to promote low impact riding.
- Park trailhead interpreters to pass out information on proper trail behavior
- Mobilize bike-equestrian patrols
- Increase staff patrol
- Cite violators of trail regulations
- Design trails for speed control (narrow trails, pinch points, obstacles, rough surfaces)
- Design trails for safe passing (strategically placed widened areas, pull out zones)
- Line of sight modifications
- Re-route trails
- Build new trails
- Alternate use restrictions, i.e. bikes one day, horses and walkers another day
- Alternate use by time of day
- Adherence to trail maintenance schedules
- Adopt-a-trail for maintenance by volunteers
- Require cyclists and equestrians to wear helmets
- Disperse use by opening more trails
- Separate trailheads for a central trail system
- Partnerships and MOUs with user groups
- Promote multi-use events, i.e. barbecues, poker rides, trail building, volunteer celebrations
- Use walk your bike zones
- Create multi-use trail advisory committees
- Designate “high speed” trails and “low speed” trails
- Use “stacked loop” trail system design to disperse users
- Keep trails narrow to slow users and reduce environmental impact
- Prohibit off trail travel
- Design trails with sustainable grades
- Use a trail permit/pass system to control trail carrying capacity (permits issued according to proportional size of user group)
- Deploy rangers on bikes and horses in parks.
- Close trails to horses when other less drastic measures have failed
- Close trails to bikes when other less drastic measures have failed

2.11 AESTHETICS AND VIEWS

A few commenters refer to analysis of visual effects of the Program (Letter O-5, page 8 & 117; Letter O-13, page 4; Letter O-13, page 4). Specific topics raised include the following:

- Because the desired trail experience differs among user groups; therefore, impacts will be perceived differently. To the extent possible, the PEIR should describe desired aesthetic experience of different user groups (Letter O-13, page 4).
- Aesthetic impacts will vary with specific conditions of a site (Letter O-5, page 8).

2.12 TRANSPORTATION

A commenter states that secondary and cumulative impacts from more parking space demand at trail heads to accommodate added uses will be an impact (Letter I-11, page 2).

2.13 NOISE

No substantive comments were provided related to noise impacts that would result from change-in-use.

2.14 POPULATION AND HOUSING

No substantive comments were provided related to population and housing impacts from change-in-use.

2.15 PUBLIC SERVICES AND UTILITIES

No substantive comments related to public services and utilities were provided in the NOP comment letters. Refer to 'Security and Emergency Preparedness' below for comments related to police and ambulance service.

2.16 SECURITY AND EMERGENCY PREPAREDNESS

Commenter states that because the State does not have the money or staff to police destructive bikers, and that the environmental consequences associated with problem bikers includes significant impacts to plants, animals, habitats, erosion, visual resources, and the experience for other users (Letter O-5, Exhibit D-H). Commenter suggests that mitigation for such impacts could include more funds for enforcement and patrolling, significant penalties, or the requirement of bikers to obtain a license or be visually identifiable (ex. wear a number on trails or affix an easy to read license plate to their bike) on State trails (Letter 0-5, page 7).Commenter states that rescue and medical costs should be examined in the PEIR. The public likely bears the cost of the consequences of mountain bike accidents even though they may be predominantly single user accidents (Letter I-11, page 2).

2.17 CUMULATIVE

Commenter state that cumulative impacts on special-status species must be addressed. This will be addressed in the PEIR (Letter O-7, page 3).

2.18 ALTERNATIVES

A commenter requests including an alternative provided that strikes a balance between user demands, environmental protection, mitigation and allocation of park resources. The scope of the alternatives might consider: 1) Evaluating the ratio of miles of trails to the size of the user group. For example, crowding of one large user group on a small number of trails may lead to higher impacts. Dispersing use may relieve some of these impacts. 2) Defining a trail so that the desired experience is provided. For example, agree that a fire road is not a trail (but can link single track experiences together) and that a narrow trail may have fewer environmental consequences than a larger road. 3) Inventorying trail systems so that park units can identify environmental degradation, barriers, gaps in demands, and implement remedies (Letter I-14, page 2).

3 PEIR PREPARATION GUIDANCE

3.1 IDENTIFICATION OF INFORMATION NEEDS AND STUDIES NEEDED TO SUPPORT THE PEIR TO COMPLETE THE PEIR SECTIONS

Three technical studies have been approved to address key issues and build a foundation for the PEIR.

3.1.1 TRAIL USE CONFLICT AND SAFETY ASSESSMENT

Investigate field records, existing studies, and available data regarding trail use conflicts between different types of users (i.e., hikers, equestrians, mountain bikers, and motorized accessibility users) on California State Park trails and other California and U.S. multiple use trails. The purpose of the assessment will be to develop factual evidence about the nature, frequency, social issues, and safety consequences of trail use conflicts for use in the PEIR trail use conflict section and to critique existing studies for objectivity (including identifying the author and sponsor, where known) and whether they address solutions related to design or management programs (such as speed controls, sight distance, or etiquette-promoting programs). The work product would be a stand-alone assessment that could be used as an appendix from which the EIR section would be prepared. Attend a workshop in Sacramento to discuss and get feedback on preliminary findings. (Alta Planning and Design/Greenways)

3.1.2 ROAD AND TRAIL CHANGE-IN-USE EROSION POTENTIAL AND CONTROL PRACTICES FOR MAJOR SOIL TYPES

Evaluate approaches to geographically organizing erosion vulnerability characteristics that would be potentially viable for use in evaluating environmental impacts of the road and trail change-in-use process. Evaluate the differences in erosion potential for major soil types and meteorological conditions relevant to road and trail change-in-use projects expected from the proposed process for the purpose of organizing the PEIR impact analysis and refining management practices to control erosion. The approach should be practical for Districts to use in evaluating and defining management responses for their projects as part of the change-in-use process. The work product would be a stand-alone appendix to the PEIR and would inform the environmental setting and impact analysis of the PEIR. Attend a workshop in Sacramento to discuss and get feedback on preliminary findings. (Pacific Watershed Associates)

3.1.3 ECOSYSTEM-BASED ORGANIZATION OF ROAD AND TRAIL CHANGE-IN-USE PROJECT IMPACTS

Evaluate approaches to geographically organizing ecosystem characteristics that would be potentially viable for use in evaluating environmental impacts of the road and trail change-in-use process. These will include, but not necessarily be limited to, California Biodiversity Council Bioregions (10), California Wildlife Action Plan regions (8), geomorphic provinces (13), and landscape provinces (9). Based on the evaluation of the advantages and disadvantages of different approaches, a preferred approach will be selected in coordination with State Parks and an ecosystem setting description suitable for inclusion in the PEIR will be prepared with accompanying maps. Attend a workshop in Sacramento to discuss and get feedback on preliminary findings. (Ascent Environmental)

3.2 Preliminary Project Schedule for PEIR

The following table outlines the schedule anticipated for completion of the PEIR.

Project Task/Milestone	No. of Weeks after Notice to Proceed	Schedule Assumptions for Lead Agency/Applicant Tasks
Notice to Proceed	0	
Kick-off Meeting	1	
Receive project info and technical studies	2	
Submit detailed project description to State Parks	4	
	6	2-week review of detailed project description
Submit ADPEIR to State Parks	12	
	15	3-week review of ADPEIR
Submit Screencheck DPEIR to State Parks	17	
	19	2-week review of Screencheck DPEIR
DPEIR public release	22	
DPEIR public hearings (2)	26	
DPEIR Public Review Period Closes	28	
Submit Administrative Final PEIR and draft MMRP to State Parks	34	
	38	4-week review of Administrative Final PEIR
Publish Final PEIR	40	
Submit Findings of Fact, Statement of Overriding Cons, MMRP	41	
EIR Certification	43	
File Notice of Determination	43	

3.3 Preliminary Outline of the PEIR

The preliminary outline of the PEIR is presented below. This outline may be revised as the environmental evaluation is completed for the Draft PEIR.

Chapter **Page**

Appendices

List of Tables

List of Exhibits

4 REFERENCES AND ATTACHMENTS PROVIDED IN NOP COMMENT LETTERS

The following is a list of attachments, websites, and citations that were provided in various comment letters. These attachments and references will be reviewed and, as appropriate, some of these resources may be used in the PEIR environmental analysis.

NOP Comment Letter O-5:

References *http://biodiversity.ca.gov/mou.html* ; Memorandum of Understanding: California's Coordinated Regional Strategy to Conserve Biological Diversity*, "The Agreement on Biological Diversity,"* September 19, 1991

B. Draft Questionnaire.

C. Bioregions of California, Biodiversity Council.

D. Impact of Mountain Biking - Palos Verdes Nature Preserve, compiled by Lynn Brown.

E. Article "Trail Wars at Annadel State Park" dated July 6, 2010

F. Summary of personal reports of incidents involving bikers, compiled from Park Watch.org

G. CET&LC Safety Considerations for Multi-use Trails.

H. Motion to Intervene, Lake Oroville Relicensing, Federal Energy Regulatory Commission, March 31, 2006

NOP Comment Letter O-9:

For additional consideration of trail conflict and the research conducted on its causes and solutions, please refer to the following sampling of studies:

- Hoger & Chavez (1998). Conflict and management tactics on the trail. Parks & Recreation, 33(9), 41-49.
- Moore, (1994). Conflicts on Multiple-Use Trails: Synthesis of Literature and State of Practice. Washington, D.C.: Federal Highway Administration.
- Ramthum (1995). Factors in user group conflict between hikers and mountain bikers. Leisure Sciences, 17(3), 159-170
- Schneider (2000). Revisiting and revising recreation conflict research. Journal of Leisure Research, 32(1), 129-132.
- Vaske, Donnelly, Karin & Laidlaw (1995). Interpersonal versus social-values conflict. Leisure Sciences, 17(3), 205-222

Some examples of research conducted that compare the effects of bicyclists with other trail users:

- Marion & Wimpey, (2007). Environmental Impacts of Mountain Biking: Science Review and Best Practices. Originally published in Managing Mountain Biking: IMBA's Guide to Providing Great Riding (2007).
- Bjorkman, Alan. 1996. Off Road Bicycle and Hiking Trail User Interactions: A Report to the Wisconsin Natural Resources Board. Wisconsin Department of Natural Resources: Bureau of Research.

- Chiu, Luke and Kriwoken, Lorne. Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia. *Annals of Leisure Research*, (in press).
- Crockett, Christopher S. 1986. Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park. Santa Clara County (CA) Parks Department.
- Gander, Hans and Ingold, Paul. 1996. Reactions of Male Alpine Chamois Rupicapra r.rupicapra to Hikers, Joggers and Mountainbikers. *Biological Conservation* 79:107 - 109.
- Goeft, Ute and Alder, Jackie. 2001. Sustainable Mountain Biking: A Case Study from the Southwest of Western Australia. *Journal of Sustainable Tourism* 9(3): 193 - 211.
- Herrero, Jake and Herrero, Stephen. 2000. Management Options for the Moraine Lake Highline Trail: Grizzly Bears and Cyclists.
- Papouchis, Christopher M. and Singer, Francis J. and Sloan, William. 2001. Responses of Desert Bighorn Sheep To Increased Human Recreation. *Journal of Wildlife Management* 65(3): 573 - 582.
- Spahr, Robin. 1990. Factors Affecting The Distribution Of Bald Eagles And Effects Of Human Activity On Bald Eagles Wintering Along The Boise River. Boise State University.
- Taylor, Audrey R. and Knight, Richard L. 2003. Wildlife Responses to Recreation and Associated Visitor Perceptions. *Ecological Applications* 13(4): 951 - 963.
- Thurston, Eden and Reader, Richard J. 2001. Impacts of Experimentally Applied Mountain Biking and Hiking on Vegetation and Soil of a Deciduous Forest. *Environmental Management* 27(3): 397 - 409.
- Weesner, Meg. 2003. Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona, National Park Service.
- Wilson, John P. and Seney, Joseph. 1994. Erosional Impacts of Hikers, Horses, Motorcycles and Off-Road Bicycles on Mountain Trails in Montana. *Mountain Research and Development* 47(1): 77 - 88.

NOP Comment Letter O-11 attachments/links:

Environmental Impacts of Mountain Biking: Science Review and Best Practices. http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices. By Jeff Marion and Jeremy Wimpey. 2007. Also provided as attachment in Comment Letter O-11.

http://www.imba.com/resources/research/environmental-impacts

http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices

NOP Comment Letter I-14:

www.americantrails.org (provides information on environmental impacts caused by various user groups

Scoping Report

Road and Trail Change-In-Use Evaluation Process
Program Environmental Impact Report
Volume 2 - Appendices



PREPARED FOR:

California Department of Parks and Recreation
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814

March 18, 2011

Road and Trail Change-In-Use Evaluation Process

Scoping Report for the Program Environmental Impact Report
Volume 2 Appendices

Prepared for:

California Department of Parks and Recreation
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814

Contact:

Gary Waldron
Environmental Program Manager
Phone: (916) 445-8772
email: gwald@parks.ca.gov

Prepared by:

Ascent Environmental, Inc.
455 Capitol Mall, Suite 210
Sacramento, CA 95814
www.ascentenvinc.com

Contact:

Curtis Alling
Principal
916.444.7301

March 18, 2011

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TABLE OF CONTENTS

Appendix A

Notice of Preparation

September 16, 2010

SCH # 2010092023

State of California
The Resources Agency
California Department of Parks and Recreation

REVISED NOTICE OF PREPARATION

RECEIVED
SEP 16 2010
STATE CLEARING HOUSE

Date: September 16, 2010

PROJECT TITLE: **Road and Trail Change-in-Use Evaluation Process**
Program Environmental Impact Report
State Clearinghouse Number 2010092023

This Notice of Preparation (NOP) revises and supersedes the previously released NOP dated September 8, 2010 for the Road and Trail Change-in-Use Program Environmental Impact Report (EIR). The revisions are related to a changes in the name of the program, date of one scoping meeting, and due date for public comments about the scope of environmental issues in the Program EIR.

INTRODUCTION AND OBJECTIVES:
The California Department of Parks and Recreation (California State Parks) proposes to implement the Road and Trail Change-in-Use Evaluation Process (Program) to facilitate the review of proposals to add or change uses of existing recreational roads and trails in the State Park System. The Program is intended to facilitate consideration of changes in non-motorized uses of existing State Park roads and trails to best accommodate accessibility and recreational activities that are appropriate for each road or trail facility. The Program seeks to provide California State Parks with an objective process and evaluation tool to assess proposals to modify roads and trails to add or remove recreational uses.

A Program EIR is being prepared to evaluate the potential environmental effects of the proposed Program. The Program EIR is being prepared in compliance with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines.

California State Parks is the Lead Agency for the Program, as defined by CEQA. The project description, location, and possible environmental effects are included with this notice. We are now seeking input from agencies, organizations and the public to further define the project, develop alternatives, and discuss potential environmental impacts and mitigations.

CALIFORNIA STATE PARKS CONTACT PERSON FOR QUESTIONS ABOUT THE PROGRAM:
Gary Waldron, Environmental Program Manager
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
Telephone: (916) 445-8772
Email: gwald@parks.ca.gov

SCH # 2010092023

SEND COMMENTS ON THE SCOPE OF THE PROGRAM EIR TO:
Heidi West, Environmental Coordinator
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
Fax: (916) 445-8883
Email: ceqansc@parks.ca.gov (Subject Line: Change In Use)

Due to time limits mandated by State law, please submit comments to the Contact below **no later than November 30, 2010.** Include the full name, telephone number with area code, and email address of a contact person for your agency or organization with each submittal.

PUBLIC SCOPING MEETINGS:
Affected agencies, organizations, and the public are invited to scoping meetings to be held at the following dates, times, and places. These scoping meetings also meet the requirements in Section 15082(c) of the State CEQA Guidelines.

Saturday, September 25, 2010
1:00 to 4:00 pm open house
Program presentation at 2:00 pm
Candlestick Point State Recreation Area
1150 Carroll Avenue
San Francisco, CA 94124

Saturday, November 13, 2010
1:00 to 4:00 pm open house
Program presentation at 2:00 pm
Lake Activities Building
Lake Perris State Recreation Area
17801 Lake Perris Drive
Perris, CA 92571

PROJECT DESCRIPTION:
This Program applies to decisions that are made for the addition or removal of different types of non-motorized uses of a State Park System road or trail. These types of use may include: pedestrian, accessible pedestrian, wheelchair, equestrian, mountain bike, road bike, in-line skating, or other unidentified non-motorized uses not currently recognized as potential road and trail use types.

Potential project actions that may result from recommendations for a change-in-use type include: reconstruction or rehabilitation of an existing road or trail prism; installation of speed control or separation devices to protect different user types; minor rerouting of trail alignments to correct otherwise unsustainable road and trail grades, or to resolve an existing environmental problem; installation of hardened surfaces, such as, but not limited to, aggregate surfacing, rock armoring, wooden boardwalks or puncheons and bridging; closure, decommissioning, and restoration of existing roads and trails; conversion of roads to trails; and trailhead, point of access, and parking improvements related to changes in recreational road or trail use.

In general, project actions that are eligible for coverage by the program would involve modifications within the corridor of an existing road or trail. Construction would be limited to the existing disturbed area of the road or trail and adjacent lands.

Any proposed project actions that are taken with regard to trails and roads qualifying for change-in-use as a result of the application of the proposed Trail Use Change Process will be required to meet Standard Project Requirements (i.e., environmental protection features) established for trail projects with the objective of making them as "self-mitigating" as feasible. These Standard Project Requirements have been developed to protect resources and avoid impacts to cultural and natural values that may be affected by any of the trails project actions. The complete list of Standard Project Requirements for trails will be included in the Program EIR.

Standard Project Requirements include measures to avoid and minimize environmental effects that are incorporated into the design of a trail project. The requirements can be defined as a result of detailed testing, inventories, studies, and documentation that performed before any surface disturbing activity occur as part of the road or trail modifications approved through the change-in-use process. They also include project construction activities that must be used, such as vegetative removal strategies, dust and erosion abatement techniques, seasonal and soil moisture restrictions for construction, and appropriate resource avoidance methods. The Standard Project Requirements also set inspection and maintenance standards for construction activities on trails to avoid environmental problems associated with earthquake damage, flooding, spill prevention, and storm water pollution prevention.

PROJECT LOCATION:
The Road and Trail Change-in-Use Evaluation Process could be applied to roads and trails in all state parks, state recreation areas, and state beaches of the California State Park System that are owned and managed by the state. The analysis will be organized in the context of the 10 bioregions established by the California Biodiversity Council in order to characterize environmental effects of road and trail change-in-use proposals in the relevant context of different ecosystems.

PROBABLE ENVIRONMENTAL EFFECTS:
The Program EIR will identify and describe the potential environmental effects associated with implementing the Road and Trail Change-in-Use Evaluation Process. Mitigation measures will be identified that may reduce or eliminate potentially significant and significant effects. The following environmental topic areas may be affected by the proposed program, which will be addressed in the Program EIR:

Terrestrial Biological Resources
Aquatic Biological Resources
Geology, Soils and Minerals
Hydrology, Water Quality, and Erosion/Sedimentation
Cultural Resources
Hazards and Hazardous Materials
Aesthetics and Views
Transportation
Greenhouse Gas/Climate Change/Energy Resources
Air Quality
Noise
Public Services and Utilities

INTENDED USES OF THE PROGRAM EIR:
The Road and Trail Change-in-Use Evaluation Process EIR is a Program EIR under Section 15168 of the State CEQA Guidelines. Later activities that are consistent with the program evaluated in this EIR can

benefit from streamlining of the CEQA process. As new site-specific actions are proposed in park units under this program, California State Parks will use a checklist to document the evaluation of the site and the actions proposed to determine whether the environmental effects are covered in this Program EIR. If the evaluation process confirms that no new effects would occur and that no additional mitigation measures would be necessary, California State Parks can approve the actions as being within the scope of the Program EIR, and no new environmental document would be required. If additional significant impacts not addressed in this Program EIR are identified, they will be evaluated in later, project-specific CEQA documentation, in accordance with the State CEQA Guidelines.

Appendix B

Compiled List of Comments
Resulting from the NOP

Appendix B
Comments Received Regarding the Notice of Preparation

Letter #	Entity	Author(s) of Comment Letter/e-mail	Date Sent
State Agencies			
S-1	San Francisco Bay Conservation and Development Commission	Timothy Doherty, Coastal Program Analyst	10/7/2010
S-2	California State Parks, Inland Empire District	Ron Krueper, District Superintendent	11/16/2010
Organizations			
O-1	Bicycle Trails Council of the East Bay	Brent Englund	10/7/2010
O-2	El Dorado Equestrian Trails Foundation	Jerry Scribner, President	10/24/2010
O-3	Equestrian Trails, Inc.	Lynn Brown	11/13/2010
O-4	Tamalpais Conservation Club	Steven Schoonover	11/26/2010
O-5	California Equestrian Trails & Land Coalition	William O. Davis, Attorney at Law	11/29/2010
O-6	Marin Horse Council	Joel Bartlett, President	11/29/2010
O-7	San Bernardio Valley Audubon Society	Drew Feldmann, Conservation Chair	11/29/2010
O-8	Equestrian Trails, Inc.	Lynn Brown	11/29/2010
O-9	International Mountain Bicycling Association	Tom Ward IMBA California Policy Director	11/29/2010
O-10	Bay Area Ridge Trail Council	Bern Smith, South Bay Trail Director	11/30/2010
O-11	San Diego Mountain Biking Association	Russel Boggs and Gardner Grady, President	11/30/2010
O-12	Wendell & Inez Robie Foundation (WIRF)	Jim Larimer, Executive Director	12/12/2010
O-13	Marin Conservation League	Nona Dennis, President	11/30/201
Individuals			
I-1	Email	Mike Vandeman	8/25/2010
I-2	Public Meeting	Larry Minikes	9/25/2010
I-3	Public Meeting	Connie Berto	9/25/2010
I-4	Public Meeting	Connie Berto	9/25/2010
I-5	Public Meeting	Connie Berto	9/25/2010

Appendix B Comments Received Regarding the Notice of Preparation			
Letter #	Entity	Author(s) of Comment Letter/e-mail	Date Sent
I-6	Public Meeting	Carol Colbert	9/27/2010
I-7	Email	C. Delos Putz	11/1/2010
I-8	Public Meeting	Emily Gabel	11/13/2010
I-9	Public Meeting	Jim Hasenauer	11/13/2010
I-10	Public Meeting	George Hague	11/13/2010
I-11	Email	Emily Gabel	11/29/2010
I-12	Fax	Donna Williams	11/30/2010
I-13		Janice and Christopher Myers	12/8/2010
I-14	Email	Cathy Haagen-Smit	12/22/2010
I-15		Bud Hoekstra	9/23/2010

Making San Francisco Bay Better

October 7, 2010

Gary Waldron
California Department of Parks and Recreation
One Capitol Mall, Suite 410
Sacramento, CA 95814

SUBJECT: BCDC Inquiry File MC.MC.1004.1 – Notice of Preparation (NOP) for a road and trail change-in-use program Draft Environmental Impact Report (DEIR). SCH# 2010092023.

Dear Mr. Waldron:

Thank you for the opportunity to comment on the Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR), dated September 9, 2010, and received in our office on September 13, 2010. These are staff comments based on the San Francisco Bay Conservation and Development Commission (BCDC) laws and regulations, the McAteer-Petris Act, and the provisions of the *San Francisco Bay Plan* (Bay Plan). In particular, these comments are related to BCDC jurisdiction within the project area, public access, recreation and global climate change.

Jurisdiction and Authority. As a permitting authority along the San Francisco Bay shoreline, BCDC is responsible for granting or denying permits for any proposed fill (earth or any other substance or material, including pilings or structures placed on pilings, and floating structures moored for extended periods), extraction of materials or change in use of any water, land or structure within the Commission's jurisdiction. Generally, BCDC's jurisdiction over San Francisco Bay extends from the Golden Gate to the Sacramento River and includes tidal areas up to the mean high tide level, including all sloughs, and in marshlands up to five feet above mean sea level; a shoreline band consisting of territory located between the shoreline of the Bay and 100 feet landward and parallel to the shoreline; salt ponds; managed wetlands (areas diked from the Bay and managed as duck clubs); and certain waterways tributary to the Bay. The Commission can grant a permit for a project if it finds that the project is either (1) necessary to the health, safety or welfare of the public in the entire Bay Area, or (2) is consistent with the provisions of the McAteer-Petris Act and the Bay Plan. The McAteer-Petris Act provides for fill in the Bay for water-oriented uses where there is no alternative upland location and requires that any fill that is placed in the Bay is the minimum that is necessary for the project. The McAteer-Petris Act also requires that proposed projects include the maximum feasible public access consistent with the project to the Bay and its shoreline.

For BCDC's Bay jurisdiction, an essential part of BCDC's regulatory framework is the Commission's Bay Plan. Projects approved by BCDC must be consistent with the McAteer-Petris Act and the Bay Plan. The Bay Plan includes priority land use designations for certain areas around the Bay to ensure that sufficient areas around the Bay are reserved for important water-oriented uses such as ports, water-related industry, parks, and wildlife areas. There are Waterfront Park, Beach priority use areas managed by California State Parks such as Angel Island SP and East Shore SP. Projects within BCDC's jurisdiction that are inconsistent with these designations require an amendment to the Bay Plan.

Public Access. Section 66602 of the McAteer-Petris Act states in part that "existing public access to the shoreline and waters of the San Francisco Bay is inadequate and that maximum feasible public access, consistent with a proposed project, should be provided." Furthermore, the McAteer-Petris Act authorizes the placement of fill in the Bay only for water-oriented uses or minor fill for improving shoreline appearance or public access.

If any projects identified in the DEIR may require bay fill or new shoreline development within BCDC's jurisdiction, then the DEIR should consider that BCDC policies on public access state, in part, "maximum feasible access to and along the waterfront and on any permitted fills should be provided in and through every new development in the Bay or on the shoreline."

Recreation. Bay Plan findings state, in part, "The Bay is the most important open space in the Bay region. The Bay and its shoreline provide unique recreational opportunities…but the full recreational potential of the Bay has by no means been reached. Bay Plan policies state, in part, "Recreational facilities should be feasible from an engineering perspective and be consistent with the public access policies that address wildlife compatibility and disturbance. Access to marinas, launch ramps, beaches, fishing piers, and other recreational facilities should be clearly posted with signs and easily available from parking reserved for the public".

Accordingly, the DEIR should discuss how the Road and Trail Change-In-Use Program may impact recreational opportunities and public access along the Bay shoreline. Furthermore, the DEIR should recognize that Bay Plan policies state, in part, "diverse and accessible water-oriented recreational facilities such as marinas, launch ramps, beaches, and fishing piers, should be provided to meet the needs of a growing and diversifying population, and should be well distributed around the Bay and improved to accommodate a broad range of water-oriented recreational opportunities for people of all races, cultures, ages and income levels."

Sea Level Rise and Safety of Fills. BCDC recently conducted an assessment of the region's vulnerability to sea level rise which is based on a projected 16-inch sea level rise at mid century (2050) and 55-inch sea level rise at the end of the century (2100). Bay Plan findings and policies anticipate the need for planning associated with safety of fills and sea level rise. The safety of fills findings state, in part, "structures on fill or near the shoreline should be above the highest expected water level during the expected life of the project…Bay water levels are likely to increase in the future because of a relative rise in sea level… Relative rise in sea level is the sum of: (1) a rise in global sea level and (2) land elevation change (lifting and subsidence) around the Bay." Bay Plan policies on safety of fills state, in part, "local governments and special districts with responsibilities for flood protection should assure that their requirements and criteria reflect future relative sea level rise and should assure that new structures and uses attracting people are not approved in flood prone areas or in areas that will become flood prone in the future, and that structures and uses that are approvable will be built at stable elevations to assure long-term protection from flood hazards." Projects in BCDC jurisdiction that involve bay fill must be consistent with the Bay Plan policies on the safety of fill and sea level rise.

Accordingly, the DEIR should discuss the potential for climate change impacts such as inundation and its impacts on biological resources, transportation, hydrology and water quality, hazards, cultural resources, utilities and public services. In addition, if there is a Global Climate Change section of the DEIR it should aim to address both mitigation and adaptation measures.

Thank you for the opportunity to comment on the NOP for the DEIR. If you have any questions regarding this letter please contact me directly at (415) 352-3667 or by e-mail at timd@bcdc.ca.gov.

Sincerely,

TIMOTHY DOHERTY
Coastal Program Analyst

Amber Giffin

From: Curtis Alling
Sent: Wednesday, November 17, 2010 8:09 AM
To: Kristen Stoner
Subject: FW: DPR Public Meeting for Road & Trail Change-In-Use Program ON BEHALF OF GARY WALDRON

From: Waldron, Gary [mailto:gwald@parks.ca.gov]
Sent: Wednesday, November 17, 2010 7:15 AM
To: 'Curtis Alling'
Subject: FW: DPR Public Meeting for Road & Trail Change-In-Use Program ON BEHALF OF GARY WALDRON

Hi Curtis,
You were not copied on the original, but here is a comment from the District Superintendent of the Inland Empire District, fyi.

Gary

Gary Waldron
Manager, Resource Services
Northern Service Center
(916) 445-8772

From: Krueper, Ron
Sent: Tuesday, November 16, 2010 6:21 PM
To: West, Heidi; Pepito, Alphonso; Salata, William; Lamb, Blaine; Brody, Brent; Ketterer, Brian; Stiny, Bruce; Hayden, Casey; Taylor, Cathy; Bardo, Chet; Phillips, Clay; Sap, Craig; Price, Curtis; Falat, Daniel; Ray, Dan; Jones, Dana; Rodriguez, Danita; Rist, Denise; Guaracha, Eddie; ehjels@parks.ca.gov; Sevrens, Gail; Aitchison, Garratt; Horvitz, Heidi; hfields@hearstcastle.com; Chamberlin, Jay; jeff_bomke@partners.nps.gov; McReynolds, Jeremy; Cooper, Jess; Danielson, Joanne; Rowe, John; Milligan, Joe; jortiz@hearstcastle.com; Tallman, Karl; Amann, Kathleen; Dice, Kathy; Weatherman, Kathy; Elliott, Kelly; Kramer, Kenneth; Gresham, Kent; Forrester, Kevin; klingerfelter@parks.ca.gov; Sencenbaugh, Lee; Rath, Linda; Burko, Liz; Linkem, Marilyn; Hada, Mark; Pass, Mary; Fuzie, Mat; Green, Matt; Fehling, Michael; Ferry, Mike; Gardner, Michelle; Lynch, Mike; Zeitler, Morgan; Martinez, Nedra; nfranco@hearstcastle.com; Armas, Pam; Hammond, Paul; Keel, Paul; Haydon, Rich; Dennison, Richard; Rozzelle, Rich; Reisenhofer, Richard; rgaebert@park.ca.gov; Clark, Ronie; Nakaji, Scott; Wassmund, Scott; Woods, Sean; Bachman, Stephen; Bylin, Stephen; Grove, Susan; Jackson, Ted; Lewis, Todd; Sereno, Vince
Cc: Waldron, Gary; DuMont, Patti; Musillami, Steve; Breece, Wayne; Tobias, Kathryn; Knapp, Karl
Subject: RE: DPR Public Meeting for Road & Trail Change-In-Use Program ON BEHALF OF GARY WALDRON

Gary and All

Shouldn't the NOP also list "Wilderness and Recreation" under Probable Environmental Effects? The project description lists several potential project actions that may result in recommendations for a change in use type: however, specifically listed are "closure, decommissioning." Closing, removing or restricting certain trail user groups on particular road or trail would affect a previously established recreation use and pattern.

For instance, as you know, with the equestrian and mt. bike groups, certain trails within parks are extreme favorites. If an evaluation of a particular trail indicated closing or eliminating a user group and it is a favorite or a significant regional trail circulating route (inside or outside a park) we would face great public outcry and opposition. So I guess this is where we fall back to the last sentence quantifier of the NOP, "If additional significant impacts not addressed in the program EIR are identified, they will be evaluated in later, project specific CEQA documentation, in accordance…"?

I unfortunately did not attend these public meetings, but was this brought up by user groups?

Ron Krueper
District Superintendent
California State Parks
Inland Empire District
17801 Lake Perris Drive
Perris, CA 92571
(951) 940-5622

From: West, Heidi
Sent: Wednesday, November 10, 2010 1:57 PM
To: Pepito, Alphonso; Salata, William; Lamb, Blaine; Brody, Brent; Ketterer, Brian; Stiny, Bruce; Hayden, Casey; Cathy Taylor (ctaylor@parks.ca.gov); Bardo, Chet; Phillips, Clay; Sap, Craig; Price, Curtis; Falat, Daniel; Ray, Dan; Jones, Dana; Rodriguez, Danita; Rist, Denise; Guaracha, Eddie; Eric Hjelstrom (ehjels@parks.ca.gov); Sevrens, Gail; Aitchison, Garratt; Horvitz, Heidi; Hoyt Fields (hfields@hearstcastle.com); Chamberlin, Jay; Jeff Bomke (jeff_bomke@partners.nps.gov); McReynolds, Jeremy; Cooper, Jess; Danielson, Joanne; Rowe, John; Milligan, Joe; Juventino Ortiz lll (jortiz@hearstcastle.com); Tallman, Karl; Amann, Kathleen; Dice, Kathy; Weatherman, Kathy; Elliott, Kelly; Kramer, Kenneth; Gresham, Kent; Forrester, Kevin; Kirk Lingenfelter (klingerfelter@parks.ca.gov); Sencenbaugh, Lee; Rath, Linda; Burko, Liz; Linkem, Marilyn; Hada, Mark; Pass, Mary; Fuzie, Mat; Green, Matt; Fehling, Michael; Ferry, Mike; Gardner, Michelle; Lynch, Mike; Zeitler, Morgan; Martinez, Nedra; Nicholas Franco (nfranco@hearstcastle.com); Armas, Pam; Hammond, Paul; Keel, Paul; Haydon, Rich; Dennison, Richard; Rozzelle, Rich; Reisenhofer, Richard; Roland Gaebert (rgaebert@park.ca.gov); Krueper, Ron; Clark, Ronie; Nakaji, Scott; Scott Wassmund (swass@parks.ca.gov); Woods, Sean; Bachman, Stephen; Bylin, Stephen; Grove, Susan; Jackson, Ted; Lewis, Todd; Sereno, Vince
Cc: Waldron, Gary; DuMont, Patti; Musillami, Steve; Breece, Wayne; Tobias, Kathryn; Knapp, Karl
Subject: DPR Public Meeting for Road & Trail Change-In-Use Program ON BEHALF OF GARY WALDRON

Hello Everyone,

I am emailing you on behalf of Gary Waldron, the NSC Resource Services Manager, to inform you about the second and last of two public meetings for the Road and Trail Change-In Use Program. Gary Waldron will facilitate the second public meeting scheduled at Lake Perris State Recreation Area on Saturday, November 13.

California State Parks (CSP) proposes to use the Road and Trail Change-In-Use Program to allow the Department to add and remove official recreation uses on roads and trails in State Park units. As the lead agency under the California Environmental Quality Act (CEQA), CSP filed a Notice of Preparation (NOP) on September 16, 2010 to prepare a Draft Program Environmental Impact Report (Draft PEIR) to evaluate impacts caused by implementation of the Program. CSP is now seeking public input to further define the project, develop alternatives, and discuss potential environmental impacts and mitigations.

Attached for your information are copies of the News Release distributed last week that provides information about the second public meeting and the NOP describing the Program in detail.

Regards,

Heidi

Heidi West
Environmental Coordinator
California Department of Parks and Recreation
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, CA 95814
(916) 445-8783

BTCEB

Bicycle Trails Council of the East Bay

PO Box 9583, Berkeley, California 94709-0583
510-761-6825
www.BTCEB.org

October 7, 2010

I am writing on behalf of the Bicycle Trails Council of the East Bay (BTCEB) in support of the California State Parks proposal to use the Road and Trail Change-In-Use Program (Program) to allow the Department to increase recreational use on roads and trails in the State Parks and to develop the Program Environmental Impact Report (PEIR).

The BTCEB is a non-profit educational association whose mission is to create, enhance and preserve great trail experiences for mountain bikers throughout the East Bay (San Francisco Bay Area). Since 1987, BTCEB has been bringing out the best in mountain biking by encouraging low-impact riding, volunteer trail work participation, cooperation among different trail user groups, grassroots advocacy, and innovative trail management solutions.

Multi use should be a strong goal of State Parks, and adding more opportunities for all muscle-powered users is of critical importance. Like most users of the State Parks Mountain bikers want to see the forests and mountains where we ride protected in their natural state. We believe it may be necessary to build new trails, reroute old ones, or engage in major rehabilitation of existing trails. State Parks must make it clear that the Program will not mandate sticking to existing trails.

Bicycling draws young people to outdoor activities and improves their stewardship of public lands as adults. Bicycling also is a sustainable, low-impact activity and a viable economic redevelopment option for many communities. References to "conflicts" should have no place in an environmental document, which deals with "environmental impact." User conflict is highly subjective, and based upon "perception" rather than science. Unauthorized use of current trails should also not be a basis for denying a change of use. Instead, it should be viewed as a reason to increase access, which in turn would decrease unauthorized use.

State Parks should make use of the body of information/research concerning relative impact of mountain bikes as compared with other users. They should also consider different management tools, such as alternating trails, one-way trails, signage, and education. Above all, State Parks needs to consider carefully the relative numbers of users from different groups, and reflect this in the PEIR. Mountain bikers need trails allocated to them proportional to their numbers.

Brent Englund
President
Bicycle Trails Council of the East Bay
www.btceb.org
(510) 761-6825

El Dorado Equestrian Trails Foundation
P.O. Box 321, Greenwood, CA 95635

October 24, 2010

Environmental Coordinator-Trail PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

Re: Comments in opposition to PEIR

TO WHOM IT MAY CONCERN:

Most of California's park trails are narrow and were designed for foot traffic consisting primarily of individuals walking single file or riding a horse. The fundamental flaw with the PEIR proposal is its underlying premise -----that changing trail use from foot traffic only to foot and vehicle traffic combined can be safely accommodated on most existing trails. It can't be. The trails were never designed for wheeled use of any kind. They were designed as the equivalent of sidewalks in the forest. We have known for years that wheeled vehicles and pedestrians don't mix well and it is the pedestrians who must give way or be injured. That is why under the vehicle code bicycles cannot be ridden on pedestrian walkways.

With trails, the experience is that once mountain biking becomes a predominant use on a trail, other users are driven off. The same is true of motorcycle use and snowmobile use which is one reason those sports are incompatible with hiking and snowshoeing.

Both motorized and non-motorized trail riding has become increasingly popular on dirt roads and trails. It is generally recognized that the noise, speed, and air pollution associated with motorized recreation (both summer and winter) is incompatible with foot traffic uses. For this reason State OHV parks, funded in part by fees on motorcycles have been established for this group of recreation users. Motorized vehicle use on existing trails is specifically excluded from this PEIR process.

The other wheeled vehicles on trails, mountain bikes, do not create noise or air pollution but their wheels do the same kind of damage to trails as motorcycles. The ruts become channels for water which is the number one cause of degradation of trails. The number of users increases the damage and adding mountain bikes to existing trails increases the traffic volume exponentially. Realistically, there is no mechanism to control the number of bikes on a trail once it is opened up. Nor, I should add, is there any way to control the profusion of new unauthorized trails that inevitably appear once wheeled vehicles enter the park environment. This has been a major problem in virtually every local, state, and national park where bikes are invited to use unpaved single-track trails.

The environmental damage cannot be eliminated. What has worked with motorized wheeled vehicle use is to try and confine it to specific locations and add jumps and other challenging conditions to enhance the thrill aspect of the sport. The same would work for mountain biking. There should be but so far isn't a mountain bike program like the "green sticker program" whereby the commercial interests promoting mountain bike use on trails could support increased recreational opportunities for their customers. Instead the announced goal of the International Mountain Biking Association (IMBA) and others has been to open up all existing hiking and riding trails to wheeled vehicles.

In theory environmental damage can be mitigated. However what cannot be eliminated or mitigated are the horrendous significant safety issues inherent in allowing mountain biking on narrow hiking and riding trails. As noted these trails were not designed for this use nor for the speed associated with wheeled vehicle use as opposed to walking, hiking and horseback riding. The existing trails are not only narrow but often go around blind corners as they ascend and descend steep terrain. Precipitous drop-offs next to the trail are common. The average speed of a mountain bike is 15-18 miles an hour on the level. It is much higher in many cases going downhill. This speed differential is incompatible with the much slower pace of hikers including families and children and it is extremely dangerous for equestrians. This differential speed and the hazard it presents to foot traffic is the reason bicycles are not allowed on sidewalks.

The good news is that mountain bikes can be accommodated where trails are wider than sidewalks. Where you have a well-designed trail with good lines of sight and at least a 72 inch width, there can be room for multiple users to be on the same trail at the same time. There are thousands of miles of fire roads in and around urban areas that are perfect for multi-use including mountain bikes. There are some trails in parks that are six or more feet in width with good lines of sight that can also accommodate multiple users. But no trail less than six feet in width should be eligible for a change in use designation to add wheeled vehicles under the PEIR program unless as part of the change the trail is going to be widened to facilitate the changed use and other safety issues like blind corners and drop-offs are addressed.

It is also important to note that the "Draft Trail Use Change Process (PEIR Revision)" flow chart pre-supposes the availability of a critical potential mitigation alternative. This alternative "...enforcement and patrol..." to reduce user conflicts is eyewash. Enforcement simply does not exist now and none is expected in the future. There are fewer and fewer rangers in California covering more and more territory. No one disputes that enforcement of trail user conflicts is beyond the resource capability of park rangers. Education efforts can be helpful with well-meaning trail users but are totally ineffective with a significant percentage of the members of the biking community. Signs prohibiting bikes are defaced or removed faster than rangers can put them up. Where signs are present, mountain bikers claim not to have seen them. Imagine policing our freeways with education only!

The PEIR process is presented as an environmental process designed to allow the state to rationally assess the environmental impact of allowing mountain bikes on wide trails where there is also room for other users. However unless these minimum threshold requirements of wide trails with good lines of sight are made explicit, then most of the state's hiking and equestrian trail system will be swiftly converted to wheeled vehicle use with no consideration of the safety and enjoyment of other users and little or no modification other than lip service to the notion that environmental concerns are being meaningfully identified or seriously addressed. Such a change would be a tragic loss for the users the trails were designed and built to serve and for the trails themselves.

Sincerely,

Jerry Scribner, President
El Dorado Equestrian Trails Foundation

(916)765-7399 jscribner@foothill.net

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHANGE-IN-USE PROGRAM

Name Lynn Brown

Mailing Address on file: Eq. Trails Inc 1547 N. Sierra Bonita Ave LA 90046

Email Address AKA Lynnbrown @ AOL.com

Comments All local trail users should be notified of prospected trail changes. Comment periods + accessible meetings must be arranged at times when the public can attend.
Major trail organizations should be notified well in advance of a meeting

Meeting Date 11/13/2010

You may also submit comments by email to ceqansc@parks.ca.gov no later than November 30 , 2010 (Subject Line: Change in Use).

TAMALPAIS CONSERVATION CLUB
232 East Blithdale • Room 211 • Mill Valley • CA • 94942

November 26, 2010

By Facsimile, E-mail and US Mail
(Fax 916-445-8883; e-mail cegansc@parks.ca.gov)

Heidi West – Environmental Coordinator
California State Parks
Northern Service Center
One Capital Mall
Sacramento, CA 95814

Re: PEIR (Road & Trail **Change in Use**)

Dear Ms. West:

The 99 year-old Tamalpais Conservation Club (TCC) has the following comments pertaining to State Parks' Road & Trail Change in Use Program PEIR:

1. To the extent the PEIR will more efficiently enable State Parks to assess the broad environmental effects of proposals (as opposed to site-specific effects) for road and trail change in use, the TCC favors the concept;

2. The TCC is concerned that there is no mechanism proposed to notify State Parks users (i.e. the public) of proposed changes in use. The flow chart posted at the 09/25/2010 public meeting in San Francisco indicated that input would be gathered from local trail user groups *or* something called a Local Trail Advisory Committee. Widely disseminated notification to the general public is essential to involve all users, not just a select few. Additionally, who is to determine who will be notified of proposals for change? To promote acceptance of the PEIR proposal, State Parks must guarantee that notice of all proposed trail and road use changes are publicized broadly;

3. It is unclear if there will be any published standards used by the local park unit "Evaluation Team" to evaluate the desirability or wisdom of changes in use. There certainly should be standards to avoid arbitrary decision making. CEQA provides some guidance, but there are factors that must be considered that might be beyond the scope of CEQA, such as user safety;

4. It's unclear whether *all* change in use proposals will be considered and, if not, the standards that will be used to determine which proposals will be considered and which will not be considered. The danger is that arbitrary decision-making by the park unit involved might favor one user group over another. Will the park unit have unlimited discretion to decide which proposals it will consider? Will headquarters in Sacramento dictate the nature of favored uses? The danger is that a process lacking standards will lead to arbitrary political decision-making and favoritism;

5. The TCC assumes the Public Records Act will provide the public with access to *all* records of the underlying analysis used to evaluate change of use proposals. If not, assurances must be made that all of those records must be made available to interested parties as a check on the decision-making process.

Sincerely,

Steven Schoonover

SS/nk

cc: Tamalpais Conservation Club Board of Directors

William O. Davis
Attorney at Law
PO Box 492796
Redding, CA 96049
(530) 242-1275 FAX 232-0210
bdavis@ShastaLaw.net

November 29, 2010

By email to cegansc@parks.ca.gov
Heidi West, Environmental Coordinator
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, CA 95814

RE: Revised NOP dated September 16, 2010
Road and Trail Change-in-Use Evaluation Process

Dear Ms. West and To Whom It May Concern:

On behalf of California Equestrian Trails & Land Coalition (CET&LC), we are responding to the revised NOP dated September 16, 2010. It is our understanding that the State is going to prepare a Programmatic Environmental Impact Report (PEIR) evaluating the impacts of trail use modifications. As we understand it, the NOP seeks scoping reviews and comments. Enclosed is CET&LC's response to the NOP.

The fifteen organizations that compose CET&LC represent more than 35,000 equestrians and others with significant experience in trails use and maintenance, design and installation, as well as assistance in managing and patrolling in the state parks. CET&LC also works with other user groups like the disabled and elder pedestrians. As a part of CET&LC's work to assure a safe and enjoyable trails experience for equestrians and hikers, it developed a statement on Safety Considerations for Multi-Use Trails. [A copy is attached to this response.] These safety recommendations should be considered for inclusion in the Road and Trail Change-In-Use Requirements for all trails.

Many people are unfamiliar with CEQA and CEQA processes and how to read or interpret the associated documentation. We first address the text of the NOP itself. There are points at which the NOP is not clear as to the intent or extent of the proposed projects in the new "Road and Trail Change-In-Use Program". We recognize that an NOP is not a definitive document and are not critical of the NOP; rather we are responding to the NOP while also addressing some of the confusions that have arisen as some people have read the NOP. These comments and questions are organized according to the major headings in the NOP, Items I through V. These are followed by general comments on elements we believe are critical to address in the PEIR.

CET&LC looks forward to a collaborative and productive experience in working with State Parks during the CEQA process. We look forward to a PEIR that addresses the many concerns and issues confronting State Parks and trail users in maintaining and improving the California State Parks trails system.

Yours truly,

William O. Davis

William O. Davis

WOD:ts
Encs: Response to NOP and related Exhibits

RESPONSE TO REVISED NOP ISSUED
SEPTEMBER 16, 2010

ROAD AND TRAIL CHANGE-IN-USE EVALUATION PROCESS
STATE CLEARINGHOUSE NUMBER 2010092023

California Equestrian Trails & Lands Coalition

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Contents

Response to NOP

I. Introduction and Objectives.

The NOP [attached as Exhibit A] Introduction and Objectives section states that the Program will apply to "existing recreational roads and trails”. This appears to remove consideration of new trails from the scope of the program. Is this the case? If so, are new trails or alternative trail locations intentionally excluded from the consideration of alternatives as part of the PEIR CEQA review process when such possible changes are considered at a statewide, regional or local level? Said another way, will individual unit park staff consider the installation of future new trails pursuant to the proposed Program as a way to address user concerns?

"Uses" that are "appropriate for each road or trail" are mentioned. How is appropriateness determined for existing trails during the PEIR process and later when the PEIR is used in specific parks and local areas? This is a matter of great concern for the equestrian users with whom we work.

The goal of the PEIR is said to be the creation of an "objective process and evaluation tool to assess proposals to modify roads and trails to add or remove recreational uses." What is meant by "objective" in this context? Does evaluation include only environmental effects, positive or negative, or does it also include social factors and public safety, or economic factors and ability to fund policing and management of trails? Social and economic effects can be indicators of significant impacts that might otherwise go unaddressed in an EIR, as recognized in the CEQA guidelines at section 15131. How will this issue be handled in the PEIR and by the Program? At subparagraph (b) the CEQA guidelines describe how a social or economic impact may lead to a finding of significant effect:

> b) Economic or social effects of a project may be used to determine the significance of physical changes caused by the project. For example, if the construction of a new freeway or rail line divides an existing community, the construction would be the physical change, but the social effect on the community would be the basis for determining whether the effect would be significant.

The PEIR is being prepared to evaluate "the potential environmental effects of the proposed Program." By effects of the Program, we assume this means the potential effects of the actual projects and changes of use that may occur, not the effects of the administrative processes such as holding meetings, soliciting public inputs, publishing questionnaires and the like. If we are wrong, please let us know.

A draft questionnaire [Exhibit B] has been circulated and apparently a number of meetings held to discuss its form and content. There is some confusion as to how the questionnaire fits into this PEIR process and the proposed Program. Is the questionnaire the primary method of implementing the Program? Will there be other policies or procedures involved in creating or implementing the Program? What is the timeline for implementation of the Program? The NOP also mentions "Standard Project Requirements" which will be discussed again below. How do those relate to the questionnaire?

II. Project Description.

The scope of uses included under the Program includes many existing recognized uses and also refers to "other unidentified non-motorized uses not currently recognized as potential road and trail use types". Are there any examples of such possible but unrecognized uses which presently exist? Does the scope of the project include a separate or distinct process by which a use or uses may be removed and/or a trail closed or eliminated, rather than merely modifying the existing use? This question arises because the NOP states that included in potential project actions are "closure, decommissioning" of existing trails.

It appears that an existing use and the associated trail location cannot be moved to another location that is not in the immediate vicinity of the existing use under the Program. Is that correct? The NOP states that "minor rerouting" to "correct otherwise unsustainable road and trail grades, or to resolve an existing environmental problem" may occur. And, "[c]onstruction would be limited to the existing disturbed area of the road or trail and adjacent lands". Is there a maximum distance by which a change to "adjacent lands" will be limited?

What are the "Standard Project Requirements" that are said to be mandatory? Do they presently exist in draft or final form? If not, how will they be created? The Requirements are parenthetically described as "environmental protection features". Will the Requirements include safety provisions governing conditions imposed regarding time or manner of use, and other matters which might not be characterized as "environmental" issues but which in some cases may give rise indirectly or cumulatively to environmental issues and concerns? The objective is said to be "making [the Requirements] as self-mitigating as feasible". Will there be mitigation monitoring or review of mitigation and effects of projects, even if they are as "self-mitigating as feasible" at this time? It is hard to comment on the Requirements when the "complete list" will be "included in the Program EIR" but are not yet available. Is one of the purposes of the PEIR review process to create the Requirements based upon public and other agency inputs or will it simply be reviewing an existing set of or drafts of Requirements which the agency has already created?

The NOP states that the Requirements are "a result of detailed testing, inventories, studies, and documentation that [sic] performed before any surface disturbing activity occur [sic] as part of the road or trail modification approved through the change-in-use process." Have the testing, inventories, studies and documentation already been created for the statewide Program? Do such items exist for regional or local park specific projects? How might those items be reviewed? Are such items intended to be created as part of a regional or local park project review process at some future time? Can "any surface disturbing activity" occur without these items under the Program? Who will make the determination that the items are sufficiently complete and accurate to support a decision pursuant to the Program?

III. Project Location.

The NOP states that the "analysis will be organized in the context of the 10 bioregions established by the California Biodiversity Council in order to characterize environmental effects of road and trail change-in-use proposals ..." Is the "analysis" the analysis in the PEIR for the statewide policy? Or, is this sentence referring to the later analysis performed by individual park superintendents and staff at the local park level, or both? Is this PEIR and the project considered to be of statewide significance under CEQA?

We would note that the bioregions are not intended to provide for homogenous policies throughout their individual reaches. The boundaries are not fixed and were often determined not by biological continuity but rather by existing agency property lines. [See the Council's map and statement describing how the regions were defined, copy attached as Exhibit C.] For example, the Klamath/North Coast region extends from the coast to the Mt. Shasta area. The Sierra extends from Lake Tahoe to southern California, high altitude Sierra to southern desert. While the regions may be useful as organizing tools for managing such a large state with its almost infinite variations in terrain, climate, population, history, etc., they do not seem fit for purposes of generalized mitigation measures or project Requirements upon which may be premised a categorical exemption or negative declaration for future local park-specific projects.

IV. Probable Environmental Effects.

The list of Probable Effects does not include social and economic factors, which may be relevant under the CEQA guidelines where the social or economic effects may give rise to environmental consequences or collateral and indirect effects associated with the social or economic impacts of a project. We assume the list is a draft subject to modification; if we are wrong, let us know.

Will the "no project" alternative be evaluated in the PEIR? Will it be made a part of any subsequent project reviews performed under the Program after the PEIR is approved? This is a very important issue to the equestrian and pedestrian users who are concerned with the environmental and other harms associated with high speed mountain bike use in the parks. While there may be many bikers, of all kinds, that respect the rules, behave well, and follow the existing trails, there are many, if not a good majority, who violate the rules, behave in an offensive and unsafe manner, and go out of their way to create new unauthorized trails, destroy existing trails and trail features, and drive the equestrian and pedestrian users off the trails and out of the parks. See the attached report compiled by Lynn Brown with photographs and commentary from Palos Verdes Nature Preserve [Exhibit D]. That report is representative of the experience of equestrian and pedestrian users in the State Parks throughout the State of California. Also refer to the recent article describing the trail issues at Annadel State Park [Exhibit E].

V. Intended Uses of the Program EIR.

The NOP discusses "[l]ater activities that are consistent with the program evaluated in this EIR". How is consistency determined and who will determine whether a project is consistent with the PEIR? The NOP also says that "[a]s new site-specific actions are proposed in park units under this program, California State Parks will use a checklist to document the evaluation of the site and the actions proposed to determine whether the environmental effects are covered in this Program EIR". Who in State Parks will perform the "evaluation of the site"? Can you give us some examples of what would and would not be "covered in this Program EIR"? Does the checklist already exist or will it be created as part of the CEQA review process, with public and agency inputs? As stated above, it is a seemingly impossible task to take into account the great variety of terrain and conditions in all the local parks in one set of Requirements or one PEIR at the statewide level. As the Biodiversity Council stated at the beginning of the organization's MOU:

> California is one of the most biologically diverse areas in the world. The state's rich natural heritage--vegetation cover and distribution, wildlife and fish habitat, recreation and aesthetic values, water and air quality--provides the basis for California's economic strength and quality of life. Sustaining the diversity and condition of these natural ecosystems is a prerequisite for maintaining the state's prosperity.
>
> From: http://biodiversity.ca.gov/mou.html ; Memorandum of Understanding: California's Coordinated Regional Strategy to Conserve Biological Diversity, *"The Agreement on Biological Diversity,"* September 19, 1991

VI. The Problem of the Unsafe Trail Users.

For equestrian users the most important issue in converting trails from equestrian and hiking trails to multi-use (mountain biking) trails is safety. The inclusion of mountain bikers often renders the trails unsafe for hikers and equestrians. For evidence we submit the recently developed report from Palos Verdes Nature Preserve [Exhibit D], the previous record in the Federal Energy Commission review of the Oroville Dam relicensing project [See www.ferc.gov elibrary, motion submitted 3/31/2006], and a summary of reports from the Park Watch website, sponsored by the Action Coalition of Equestrians in collaboration with the California Recreational Trails Committee [Exhibit E]. The Park Watch reports are available to local park officials and law enforcement. These three documents are substantial. We incorporate the matter included in those documents in this comment letter.

Equestrians do not oppose mountain biking when it is done within the park and trail rules. But it is very frequently and in some cases, at least, more often than not, done without regard for park and trail rules. Bikers not only go out of their way to insult other users when passing them at high speeds, they look for places to create unauthorized trails and do so with impunity. Bikers have caused serious injuries when they startled riders' horses. The most well-known may be the incident giving rise to the Annadel State Park lawsuit after a rider was rendered a quadriplegic. A recent article described a State Park Ranger’s observation that there are probably twice the number of illegal as legal trails in the 5,000-acre Annadel park [Exhibit E].

In another example, a woman described how her back was broken by a faceless, unnamed and unidentified biker when he sped past the rider's horse on a State Park trail [See the attached letter to the California State Park & Recreation Commission dated June 9, 2005]:

> I did have a bike/horse accident in September 2004. My daughter and I were riding on the Loafer Creek Orchard Loop and a mountain biker came barreling around the corner and scared the hell out of the horses. My horses started bucking like a bronco and I ended up with three cracked vertebrae, whiplash and a sprained right hand. The biker didn't even slow down. I had to calm my horse down and ride all the way back to the trailer in that shape. When I contacted the Park Department, I was told without a name, description, etc of the

> biker, they could do nothing. Tough luck. The guy had a riding helmet on and went by us at 35 mph. There is no way I could identify him or get his name.

The Palos Verdes report [Exhibit D] is graphic evidence of the environmental damage that results from the high speed antics of the dangerous mountain biker users. Again, we are not saying this is all bikers, but it is enough users such that the destruction and dangers are significant. If mountain bike use is to be added to any equestrian and hiking trail then mitigation must include speed limits, safety practices and, most importantly, effective enforcement which also serve the collateral benefit of preventing associated environmental damage. The CET&LC has created safety guidelines [Attached as Exhibit G], which are a minimum program for making trails safe when converted to multi-use. We believe that the CET&LC guidelines should serve as a template for safety requirements to be included in the Program. Such safety guidelines serve the dual purpose of providing for the public safety and defining mitigations which will reduce consequent and related environmental damage. Such mitigations are consistent with CEQA and the CEQA guidelines discussed below.

The CEQA guidelines require that mitigation must be "fully enforceable through permit conditions, agreements, or other legally-binding instruments”. In the interest of public safety and of protecting the environment, such conditions should be required and enforced when it comes to trail users. Guideline 15126.4(a)(2) states:

> (2) Mitigation measures must be fully enforceable through permit conditions, agreements, or other legally-binding instruments. In the case of the adoption of a plan, policy, regulation, or other public project, mitigation measures can be incorporated into the plan, policy, regulation, or project design.

One of the biggest problems confronting equestrians who have been harmed or threatened and intimidated by reckless mountain bikers is the absence of any formalized reporting or record keeping system for such incidents. As a related matter, there appears to be no budget for enforcement of any rules on trail use. Signs do not work. The problem bikers uniformly disobey signs which limit their use of a specific trail or park area -- including removing signs, going out of their way to create offshoots from a main approved trail or modifying that trail as shown in the report by Lynn Brown as well as experienced in parks throughout the state (see Annadel Park article). The PEIR should address these issues, and mitigation measures dealing with these issues should be incorporated into the Program Requirements and policy.

The analysis of significant effects pursuant to the CEQA Guidelines is to include both short and long term effects in the project area, including “relevant specifics of the area”. The analysis includes consideration of safety problems caused by a physical change like the inclusion of bikes on trails where they have not previously been authorized, impacts of bringing people into the project area, and scenic quality issues. Safety considerations should be considered in the PEIR and later in decisions at the local unit level. The significant effects analysis is described as follows at Guideline 15126.2(a):

> Direct and indirect significant effects of the project on the environment shall be clearly identified and described, giving due consideration to both the short-term and long-term effects. The discussion should include relevant specifics of the area, the resources

> involved, physical changes, alterations to ecological systems, and changes induced in population distribution, population concentration, the human use of the land (including commercial and residential development), **health and safety problems caused by the physical changes**, and other aspects of the resource base such as water, historical resources, **scenic quality**, and public services. The EIR shall also analyze any significant environmental effects the project might cause by bringing development and people into the area affected. (Emphasis added.)

VII. Quality of User Experience.

Another major issue for equestrians is the quality of the in-park and trail experience. Having bikers come hurtling down a narrow often winding trail to go zooming by a rider sitting atop a horse, is a frightening and threatening experience. It is the antithesis of the experience which hikers and equestrians go to the parks to enjoy. Many people go to nature for the serenity and renewal it provides. Having to be on alert for speeding bicyclists around every curve drastically changes the nature of the user experience. See Exhibit F, summaries of several incidents involving equestrians and bikers, collected through Park Watch Report.org, a collaboration between trail users and the California Recreational Trails Committee, mentioned above.

Again, the speed and behavior of the problem bikers has the collateral consequence or indirect and cumulative effect under CEQA of damaging the existing trails and parklands environment, as evidenced by the Palos Verdes report. These are significant effects, both social and environmental as described in Guideline 15126.4 and 15126.2. Mitigating that damage is best accomplished by preventing the egregious behavior to begin with, either putting time, place and manner of use restrictions that are enforced on such use or not authorizing such use in the first place under the no project alternative analysis. In any case, such mitigations are appropriate under the Guidelines as discussed above. Will such issues be addressed and mitigations defined as a part of the Program and the Program requirements? Will such issues be addressed in the PEIR?

The issue is not whether all mountain bikers are unruly and dangerous destroyers of the park environment. Not every biker is. Those bikers who are respectful of the rules, the environment and other users often claim that there are very few irresponsible and destructive bikers. That is not the case throughout the State. The Palos Verdes report [Exhibit D] is a good example and evidence; so is the common knowledge that in Marin County a great deal of damage has been done to the public lands by such bikers. The article about Annadel State Park is typical of experiences in many, if not all, of the other State Parks.

The core problem is that trails made accessible to responsible bikers are also available to irresponsible and destructive bikers. The State does not have the money and staff to police the destructive bikers. As stated by a biker in the Annadel article, State Parks is fighting a losing battle against such bikers on State Lands without effective enforcement. As evidenced in the photographic record and report from Palos Verdes and the article describing trails in Annadel State Park as only two examples, the environmental consequences of unrestrained and uncontrolled bikers has a significant negative impact on the grounds and lands. And, the impact extends to destruction and damage to plant life, death and destruction of animals and their environment, erosion and damage from climatic conditions, and destruction of the natural park experience for other users, visual and otherwise.

Such destructive effects dictate that making it a criminal offense with significant penalties would be one way in which destructive bike riders should be discouraged from continued use of our public parks, if there were funds for patrolling and enforcement. Perhaps bikers should be required to obtain licenses to use any of the authorized trails and to wear a distinguishing number or have an easy to read license affixed to their bikes in order to permit identification of those abusing the privilege of riding in State Parks.

VIII. Other State Agencies.

Will the Program impact or supersede other agency authority over land use within their jurisdiction? Such agencies would include, for example, the Coastal Commission, Regional Water Quality Control Boards, Reclamation Districts, Resource Conservation Districts, State Lands Commission, Dept. of Fish & Game, etc. We would suggest that interagency processes be defined in the PEIR so that the members of the general public can understand how the Program will work at the local level.

IX. NEPA Issues and Federal Agencies.

Because NEPA is triggered by projects at the state level where federal funding is involved, among other factors, will the PEIR address NEPA issues or processes for joint state and Federal approvals? Does this PEIR require Federal review or participation? Will individual local park unit projects require such Federal participation or review? For example, Lake Oroville State Recreation Area is under the combined jurisdiction of the Federal Energy Regulatory Commission, California Department of Water Resources, and State Parks. Fish & Wildlife, National Marine Fisheries Service, and the Army Corps may be involved with projects which have any direct or indirect impact on waters of the United States and the endangered or threatened fish or other species. Moreover, whenever projects receive federal monies, NEPA review is required by law

X. Conclusion.

CET&LC supports state parks in its commitment to expand our citizens' positive and diverse experience of nature in our remarkable state parks. These are very difficult times with severely limited budgets and a diversity of park users and needs. Even with these constraints, solutions can be found to maintain and enhance the experience of trail users. CET&LC is available to assist State Parks in this effort. The critical first step is a well-considered PEIR to assure that the environment, user safety and the quality of the nature experience are all protected.

EXHIBIT A

SCH # 2010092023

State of California
The Resources Agency
California Department of Parks and Recreation

REVISED NOTICE OF PREPARATION

Date: September 16, 2010

PROJECT TITLE: **Road and Trail Change-in-Use Evaluation Process**
Program Environmental Impact Report
State Clearinghouse Number 2010092023

This Notice of Preparation (NOP) revises and supersedes the previously released NOP dated September 8, 2010 for the Road and Trail Change-in-Use Program Environmental Impact Report (EIR). The revisions are related to a changes in the name of the program, date of one scoping meeting, and due date for public comments about the scope of environmental issues in the Program EIR.

INTRODUCTION AND OBJECTIVES:
The California Department of Parks and Recreation (California State Parks) proposes to implement the Road and Trail Change-in-Use Evaluation Process (Program) to facilitate the review of proposals to add or change uses of existing recreational roads and trails in the State Park System. The Program is intended to facilitate consideration of changes in non-motorized uses of existing State Park roads and trails to best accommodate accessibility and recreational activities that are appropriate for each road or trail facility. The Program seeks to provide California State Parks with an objective process and evaluation tool to assess proposals to modify roads and trails to add or remove recreational uses.

A Program EIR is being prepared to evaluate the potential environmental effects of the proposed Program. The Program EIR is being prepared in compliance with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines.

California State Parks is the Lead Agency for the Program, as defined by CEQA. The project description, location, and possible environmental effects are included with this notice. We are now seeking input from agencies, organizations and the public to further define the project, develop alternatives, and discuss potential environmental impacts and mitigations.

CALIFORNIA STATE PARKS CONTACT PERSON FOR QUESTIONS ABOUT THE PROGRAM:
Gary Waldron, Environmental Program Manager
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
Telephone: (916) 445-8772
Email: gwald@parks.ca.gov

SCH # 2010092023

SEND COMMENTS ON THE SCOPE OF THE PROGRAM EIR TO:
Heidi West, Environmental Coordinator
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
Fax: (916) 445-8883
Email: ceqansc@parks.ca.gov (Subject Line: Change In Use)

Due to time limits mandated by State law, please submit comments to the Contact below **no later than November 30, 2010.** Include the full name, telephone number with area code, and email address of a contact person for your agency or organization with each submittal.

PUBLIC SCOPING MEETINGS:
Affected agencies, organizations, and the public are invited to scoping meetings to be held at the following dates, times, and places. These scoping meetings also meet the requirements in Section 15082(c) of the State CEQA Guidelines.

Saturday, September 25, 2010
1:00 to 4:00 pmopen house
Program presentation at 2:00 pm
Candlestick Point State Recreation Area
1150 Carroll Avenue
San Francisco, CA 94124

Saturday, November 13, 2010
1:00 to 4:00 pm open house
Program presentation at 2:00 pm
Lake Activities Building
Lake Perris State Recreation Area
17801 Lake Perris Drive
Perris, CA 92571

PROJECT DESCRIPTION:
This Program applies to decisions that are made for the addition or removal of different types of non-motorized uses of a State Park System road or trail. These types of use may include: pedestrian, accessible pedestrian, wheelchair, equestrian, mountain bike, road bike, in-line skating, or other unidentified non-motorized uses not currently recognized as potential road and trail use types.

Potential project actions that may result from recommendations for a change-in-use type include: reconstruction or rehabilitation of an existing road or trail prism; installation of speed control or separation devices to protect different user types; minor rerouting of trail alignments to correct otherwise unsustainable road and trail grades, or to resolve an existing environmental problem; installation of hardened surfaces, such as, but not limited to, aggregate surfacing, rock armoring, wooden boardwalks or puncheons and bridging; closure, decommissioning, and restoration of existing roads and trails; conversion of roads to trails; and trailhead, point of access, and parking improvements related to changes in recreational road or trail use.

In general, project actions that are eligible for coverage by the program would involve modifications within the corridor of an existing road or trail. Construction would be limited to the existing disturbed area of the road or trail and adjacent lands.

SCH # 2010092023

Any proposed project actions that are taken with regard to trails and roads qualifying for change-in-use as a result of the application of the proposed Trail Use Change Process will be required to meet Standard Project Requirements (i.e., environmental protection features) established for trail projects with the objective of making them as "self-mitigating" as feasible. These Standard Project Requirements have been developed to protect resources and avoid impacts to cultural and natural values that may be affected by any of the trails project actions. The complete list of Standard Project Requirements for trails will be included in the Program EIR.

Standard Project Requirements include measures to avoid and minimize environmental effects that are incorporated into the design of a trail project. The requirements can be defined as a result of detailed testing, inventories, studies, and documentation that performed before any surface disturbing activity occur as part of the road or trail modifications approved through the change-in-use process. They also include project construction activities that must be used, such as vegetative removal strategies, dust and erosion abatement techniques, seasonal and soil moisture restrictions for construction, and appropriate resource avoidance methods. The Standard Project Requirements also set inspection and maintenance standards for construction activities on trails to avoid environmental problems associated with earthquake damage, flooding, spill prevention, and storm water pollution prevention.

PROJECT LOCATION:
The Road and Trail Change-in-Use Evaluation Process could be applied to roads and trails in all state parks, state recreation areas, and state beaches of the California State Park System that are owned and managed by the state. The analysis will be organized in the context of the 10 bioregions established by the California Biodiversity Council in order to characterize environmental effects of road and trail change-in-use proposals in the relevant context of different ecosystems.

PROBABLE ENVIRONMENTAL EFFECTS:
The Program EIR will identify and describe the potential environmental effects associated with implementing the Road and Trail Change-in-Use Evaluation Process. Mitigation measures will be identified that may reduce or eliminate potentially significant and significant effects. The following environmental topic areas may be affected by the proposed program, which will be addressed in the Program EIR:

Terrestrial Biological Resources
Aquatic Biological Resources
Geology, Soils and Minerals
Hydrology, Water Quality, and Erosion/Sedimentation
Cultural Resources
Hazards and Hazardous Materials
Aesthetics and Views
Transportation
Greenhouse Gas/Climate Change/Energy Resources
Air Quality
Noise
Public Services and Utilities

INTENDED USES OF THE PROGRAM EIR:
The Road and Trail Change-in-Use Evaluation Process EIR is a Program EIR under Section 15168 of the State CEQA Guidelines. Later activities that are consistent with the program evaluated in this EIR can

benefit from streamlining of the CEQA process. As new site-specific actions are proposed in park units under this program, California State Parks will use a checklist to document the evaluation of the site and the actions proposed to determine whether the environmental effects are covered in this Program EIR. If the evaluation process confirms that no new effects would occur and that no additional mitigation measures would be necessary, California State Parks can approve the actions as being within the scope of the Program EIR, and no new environmental document would be required. If additional significant impacts not addressed in this Program EIR are identified, they will be evaluated in later, project-specific CEQA documentation, in accordance with the State CEQA Guidelines.

EXHIBIT B

Trail Use Change Survey

Version 1-July 2008

Park (Including Classification): ____________________

Trail Name: ____________________

Location in Unit: ____________________

Current Use Designation(s): ____________________

Proposed Use Type Change: ____________________

Use Change Initiated By: ____________________

Evaluation Date: ____________________

Evaluation Criteria

	Yes	No
Based on Criteria, is this Use Change Compatible?		
Based on Criteria, does this Use Change Enhance Circulation?		
Based on Criteria, will this Use Change Decrease Trail Safety?		
Based on Criteria, is the Trail Sustainable Under Existing Use Conditions?		
With the Proposed Use Change Will the Trail be Sustainable		
Based on Criteria, will the Proposed Used Change Create Negative Impacts to the Natural or Cultural Resources?		
Will the Proposed Use Change and/or Modifications to the Existing Trail Create Significant Facility Maintenance or Operational Work Load?		
Are there other Routes in the Unit or on Nearby Public Lands that Adequately Accommodate the Type of Trail Use Proposed?		
Would needed modifications trigger outside agency permits?		

Recommendation Based on Evaluation Criteria - Substantiate in Comment Box

Recommend that the Park's General Plan or Road and Trail Management Plan be Developed or Amended to Evaluate this Change in Use		
Recommend that the Proposed Change in Trail Use be Approved		
Recommend that the Proposed Change in Trail Use be Approved After Design Modifications are Implemented:		
Recommend that the Major Reroute be Considered to Accommodate Proposed Change in Use		
Recommend that the Proposed Change in Trail Use be Approved with Management Options such as: Alternating Days of Use, One Way Travel, Seasonal Closures etc.		
Recommend that the Proposed Change Use be Put on Hold - See Comment Box Below		

Summary Criteria Evaluation Based on the Synthesis of Data from the Following Pages

Insert Map of Area of Proposed Use Change

Trail Use Change Survey

Version 1-July 2008

Comments:

Evaluation Team Members: ______________________ ______________________

______________________ ______________________

Multiple trail route use change proposals in one unit may recommend development or amendment of a unit wide road and trail transportation management plan.
Qualified Department District Staff, including a DPR Trained Trail Coordinator will complete this survey and checklist to:

(1) Determine the sustainability, trail user safety and feasibility of a proposed change in allowed uses for a single existing trail.

(2) Determine the appropriateness of proposed use change in relation to cumulative impacts to the existing uses (users, routing, hiking opportunities, etc)
(3) Support and Document the Request with a Project Evaluation Form and associated CEQA document.
(4) Validate the existing conditions described on the attached trail log. The trail log should address typical log elements and positive and negative attributes related to the evaluation criteria.

	Evaluation Criteria	Yes	No	Comments
	#1 Existing Conditions			Describe positive and negative impacts of the proposed change and any other details related to the question to assist decision is made . Put N/A in "No" section for criteria not applicable to trail evaluated.
	Check any existing conditions:			
1.1	Does the Park Unit have a General Plan?			
1.2	If Yes, does it address specific trail uses or other management directive supporting the proposed use change			
1.3	Is the "Trail" Proposed a Controlled Access Road			
1.4	Does the Park have an approved road and trail management plan?			
	Trail or Road Surface Type:	Check Applicable		
1.5	Asphalt			
1.6	Concrete			
1.7	Gravel			
1.8	Native Material			
	Trail and Road Facility Use Type			
1.9	Public			

Trail Use Change Survey

Version 1-July 2008

	Evaluation Criteria	Yes	No	Comments
1.10	Administration			
1.11	Fire Break			
1.12	Motorized Recreation			
1.13	Non-Motorized Recreation			
1.14	ADA Accessible Route of Travel			
1.15	Does the proposed route connect to a Trail Head or other Accessible Facility?			
1.16	Road Used as Trail Route			
	Trail Specific Facility Use Type			
1.17	Trail Class I, II, III, IV			Enter Trail Classification Here - Not Yes or No
	Current Trail Uses Allowed (on road or trail)	**Yes**	**No**	
1.18	Pedestrian			
1.19	Mountain Bike			
1.20	Equestrian			
1.21	Other - Specify in Comment Box			
	#2 Compatibility for Multi-User Trails			
	Check any existing conditions:			
2.1	Would the proposed use change create incompatible conflict with existing facilities (trail heads, stables, campgrounds etc)?			
2.2	Is it located on a trail already in a high use area and are there resource impacts?			
2.3	Is there significant user conflict?			
2.4	Is there evidence of unauthorized use?			
2.5	Is it consistent with park classification?			
2.6	Does the Proposed Use Currently Exist in the Park?			
2.7	Is there documented survey or statistical information that identifies a need for proposed additional use designation?			
2.8	Is the existing trail considered ADA accessible by US Access Board?			
2.9	Based on Above Criteria, Is this Use Change Compatible?			
	#3 Affects to Trail Unit User Circulation Patterns			
	Check any existing conditions:			
3.1	Does the proposed use change provide a loop or semi loop connection?			
3.2	Does the change provide a legal or legitimate route for existing unauthorized trail uses or user created trail?			

Trail Use Change Survey

Version 1-July 2008

	Evaluation Criteria	Yes	No	Comments
3.3	Does the change provide a connection to adjacent land agency which allows similar use?			
3.4	Does it improve circulation or relieve congestion on other high use or at capacity trails?			
3.5	Does it create potential additional use changes on surrounding/adjacent or connecting trails or facilities?			
3.6	Does it require a seasonal closure to mitigate resource impacts?			
3.7	If yes, will seasonal closures disrupt circulation patterns?			
3.8	Based on Above Criteria, Does this Use Change Enhance Circulation			
	#4 Effects to Trail Use Safety			
	Check any existing conditions:			
4.1	With standard cyclic trail brushing (as required by the trail Class), is there adequate site distance for safe warning for the proposed use change?			
4.2	With standard cyclic slough and berm removal, is there adequate tread width for safe passage for the proposed multi-user designation?			
4.3	With equestrian mutli-use, are tread widths safe for the pedestrian, mobility devices and/or bike user to retreat to the downhill side of trail?			
4.4	If tread widths for equestrian use is narrow, are the fill slopes gentle, firm and stable for the pedestrian, mobility devices and/or bike user to retreat to the downhill side of trail?			
4.5	Does the trail have sinuosity that slows bike users?			
4.6	Can sinuosity be designed into existing trail tread alignment to slow bike users?			
4.7	Does the use change require removal of special concern plant species to maintain adequate trail widths and sight distances?			
4.8	Would use type change existing conditions or cause problems for enforcement of park rules and regulations?			
4.9	Would use type change existing conditions or cause problems for emergency response?			
4.10	Would alternating days of use reduce the change of use impacts to reduce safety concerns?			

Trail Use Change Survey

Version 1-July 2008

	Evaluation Criteria		Yes	No	Comments
4.11	Based on Above Criteria, Will this Use Change Decrease Trail Safety?				
	#5 Effects on Trail Sustainability				
	Check any existing conditions:				
5.1	Are trail grades commensurate with soil types, use type, season use and facilitate natural hydrologic drainage patterns such as sheet flow?				
5.2	Is the trail drainage being captured and released on hillsides and not at natural topographic drainage features?				
5.3	Trail tread firm and stable?				
5.4	Are there abrupt changes in trail running grade?				
5.5	Is the fill slope stable?				
5.6	Is the back slope/cut bank stable?				
5.7	Does the trail tread remain firm and stable in wet conditions?				
	Supporting Data From Trail Log				
5.8	Number of Water Bars required for proper drainage				
5.9	Lineal Footage of Berms				
5.10	Lineal Footage of Ditches				
5.11	Lineal Footage Rills and Ruts				
5.12	Lineal Footage log Entrenched Trail				
	Describe the locations and different types of soil types and matrix encountered on trail	% of			
5.13	Rocky				
5.14	Rocky/Partial Soil Profile				
5.15	Full Soil Profile				
5.16	Partial Soil Profile/Sandy				
5.17	Sandy				
5.18	Based of Above Criteria, is the Trail Sustainable Under Existing Use Conditions?				
5.19	With the Proposed Use Change, will the Trail be Sustainable?				
	If Not Sustainable, Can Any of the Following Measures be Implemented to Make the Trail Sustainable for the Proposed Use Change?				

Trail Use Change Survey

Version 1-July 2008

	Evaluation Criteria	Yes	No	Comments
	Minor reconstruction of trail tread would:			
5.20	Correct lack of outslope			
5.21	Eliminate abrupt grade changes			
5.22	Stabilize unstable cut bank			
5.23	Stabilize unstable fill slope			
5.24	Correct rilling, rutting			
	Provide for firm and stable surfaces			
5.25	Minor realignment of trail within immediate existing trail proximity would:			
5.26	Stabilize unstable cut bank			
5.27	Stabilize unstable fill slope			
5.28	Eliminate abrupt grade changes			
5.29	Correct unsustainable grades			
5.30	Correct Lack of sinuosity			
5.31	Based on Above Criteria, Can the Trail be Made Sustainable for Proposed Use Conditions?			
5.32	Can wet weather closures establish or maintain Sustainability?			
5.33	Should a Major Reroute be Considered to Establish Sustainability?			
	#6 Effects or Impacts to the Natural or Cultural Resources			
	Would proposed use change and/or needed modifications significantly impact:			
6.1	erosion of existing Trail Tread?			
6.2	geologic conditions?			
6.3	sensitive wildlife habitat?			
6.4	sensitive vegetation habitat?			
6.5	a riparian or stream environment zone			
6.6	a sensitive historic feature?			
6.7	Is the Trail a historic feature?			
6.8	Based of Above Criteria, Would the Proposed Used Change Create Negative Impacts to the Natural or Cultural Resources?			
	#7 Effects or Impacts to the Facility Maintenance and Operational Costs			
	Would proposed use change and/or needed modifications:			

Trail Use Change Survey

Version 1-July 2008

	Evaluation Criteria	Yes	No	Comments
7.1	Change the current classification of the trail?			
7.2	Create the need for fill slope or cut bank retaining walls?			
7.3	Require aggregate or other trail hardening techniques required to maintain tread stability?			
7.4	Require additional or upgrading of turnpikes or causeways?			
7.5	require additional bridges or puncheons?			
7.6	Require additional maintenance to maintain current existing conditions?			
7.7	Require additional management practices to maintain user compliance?			
7.8	Could the proposed modifications be completed by non-department work forces?			
7.9	Could the proposed modifications be maintained by non-department work forces with no cost to State Parks?			
7.10	Are durable pinch point native materials readily available?			
7.11	If alternating days of use by user type is a management practice, is alternating days of use able to be enforced?			
7.12	Will the Proposed Use Change and/or Modifications to the Existing Trail Create Significant Facility Maintenance or Operational Work Loads?			

EXHIBIT C

NOP Comment Letter O-5

CALIFORNIA
BIODIVERSITY COUNCIL

Home ⇢ Resources ⇢ **Bioregions**

For a printable map of California's bioregions please go to the FRAP website.

How did the CBC decide on these bioregions? You can find out by reading this pdf document.

Conditions of Use | Privacy Policy

Interagency Natural Areas Coordinating Committee (INACC)
Working Bioregions

The Agreement on Biological Diversity calls for a state, bioregional, and watershed/landscape approach to conserving biological diversity. The California Biodiversity Council has not formally defined bioregional boundaries because this is best left up to those individuals living in each bioregion. In many cases, fuzzy boundaries may be most appropriate, depending on the specific issues being addressed.

To provide some guidance on bioregions, the Biodiversity Council has made reference to INACC bioregion boundaries. These INACC bioregions were defined as part of a process to improve communication and coordination among public and private organizations. INACC's intention was to outline regions that contained unique mixes of biodiversity and public agency responsibilities.

The 10 INACC bioregions were initially based on the state's major physiographic provinces. Several different variations of these provincial classifications exist, but they all tend to follow the basic eleven areas outlined below.

In some areas, bioregional boundaries were modified to minimize splitting up a major public land management unit. This modification was necessary to accomplish the goal of efficiently improving communication among agencies. For example, although the Klamath National Forest occurs in both the Klamath/North Coast and Modoc provinces, it is inefficient to ask the Forest staff to attend two different bioregional meetings. It made more sense to extend the Klamath/North Coast bioregion eastwards to include all of the Klamath National Forest.

The decision on which jurisdictional boundary to use as a modifier was based on which agency had the greatest local presence. In most cases, this was either the USDA Forest Service (USFS) or Bureau of Land Management (BLM). In areas with little public land, such as the Bay/Delta, county lines were more influential.

Listed below are the major features upon which the INACC bioregional boundaries are based. Please refer to the two attached maps, which describe the major public land management units, watersheds and selected habitats contained in each bioregion.

KLAMATH/NORTH COAST

Description: Bounded on west by coastline and on the north by Oregon border. Extends eastwards to include all of Klamath National Forest and Shasta-Trinity National Forest and the entire North Coast Range (down to Sacramento Valley floor). Bounded on south by southern limits of Lake and Mendocino counties.

MODOC

Description: Bounded on north by Oregon border and on the east by Nevada border. Extends west to include all of Modoc National Forest and Lassen National Forest, plus additional lands extending down to Sacramento Valley floor. Bounded on south by southern limits of Lassen National Forest and Lassen County.

SACRAMENTO VALLEY

Description: Western, northern and eastern limits are the edges of the valley floor (essentially where the blue oak woodland starts). Southern limit is the northern edge of the Sacramento-San Joaquin Delta.

BAY/DELTA

Description: Essentially the immediate watershed of the Bay Area and the Delta, not including the major rivers that flow into the Delta. Bounded on north by northern edge of Sonoma and Napa counties and the Delta and extending east to the edge of the valley floor. Bounded on the south by the southern edge of San Joaquin County, the eastern edge of the Diablo Range, the southern edge of Santa Clara and San Mateo counties.

SIERRA

Description: Bounded on north by northern edge of Plumas National Forest. Western edge is the Sacramento Valley floor. Bounded on the east by the Nevada state line and the western edge of BLM's California Desert Conservation Area. Bounded on west by the Sacramento and San Joaquin Valley floor, south to Tejon Pass in the Tehachapi Mountains.

SAN JOAQUIN VALLEY

Description: Bounded on north by the southern edge of the Delta, and on all other sides (west, south, east) by the San Joaquin Valley floor. The one major exception to this is the southwestern extension to include the Carrizo Plain and BLM-managed lands in the Caliente Resource Area (eastern San Luis Obispo county).

CENTRAL COAST

Description: Bounded on north by the northern limits of Santa Cruz and San Benito counties, and on the east by the San Joaquin Valley floor and the Carrizo Plain. The southeastern limit is the eastern and southern edges of the Los Padres National Forest. The western edge is the coastline.

MOJAVE

Description: Bounded on west by western edge of BLM California Desert Conservation Area and on east by Nevada state line. Bounded on south by the northern base of the San Gabriel and San Bernardino Mountains, the southern edge of Joshua Tree National Monument, and the southern edge of San Bernardino County (between Joshua Tree and Nevada state line).

SOUTH COAST

Description: Bounded on north by southern edge of Los Padres National Forest and the northern base of San Gabriel and San Bernardino Mountains. Bounded on east by western edge of BLM California Desert Conservation Area and on south by Mexican border.

COLORADO DESERT

Description: Bounded on west by western edge of BLM Desert Conservation Area and on north by southern edge of Joshua Tree National Monument and the southern edge of San Bernardino County. Bounded on east by Arizona state line and on south by Mexican border.

EXHIBIT D

**Impact of Mountain Biking –
Palos Verdes Nature Preserve**

[Forwarded separately due to file size]

The following pages show some of the impact that mountain biking has had and continues to have in the Palos Verdes Nature Preserve in Rancho Palos Verdes, CA.

This was prepared in an effort to inform decision makers what they can expect if they decide to permit mountain biking in Los Angeles city parks.

Mountain bikers have carved numerous trails in the Palos Verdes Nature Preserve, often down steep hillsides, over cliff faces, across pillow lava, over natural or built up "bumps," and through slow-growing native vegetation. Such trails, and their continued use, have had an adverse impact on the topography, the habitat, animal life, and other users in the Preserve. Land managers' (and volunteers') efforts to restore damaged habitat, close off unauthorized trails, and eliminate safety hazards have repeatedly been thwarted by vandalism, destruction of mitigation efforts, and disregard of signs, warnings, physical closures, and reroutings.

A number of people have been hit by mountain bikers in the Preserve. Many people tell of having been startled by mountain bikers speeding past. And many people simply no longer hike or ride their horses in the Preserve, for fear of being hit by a mountain biker or having their horse throw them after being spooked by a mountain biker.*

*Dozens of people have submitted written correspondence and spoken up at Rancho Palos Verdes City Council meetings to inform decision makers of these experiences with mountain bikers.

Photos above are from 2006 and show mountain bikers using trails they carved over a low cliff to create a favorite jump spot. Below, a more recent photo of the same area shows the damage that has been done to topography and habitat. The mountain bikers also pose a hazard to others using the primary, wide, authorized trail (at bottom left, below).

Recognizing the hazard of the jump spot pictured on the preceding page, in order to block access to it, a post and rope blockade was installed by volunteers under the land manager's supervision. Bicyclists continued to go over and around it to access the jump spot. Cactus were installed. Over several months, the cactus and the post and rope were repeatedly removed, then repeatedly replaced by volunteers.

Photo at left shows the cactus installation at the access to the jump spot pictured on the preceding page. Photo at right shows many of the cactus have been uprooted. Several times the post and rope blocking access was taken out, then replaced. Eventually the rope blocking access was cut (photo at left) and virtually all cactus were removed. August 2009

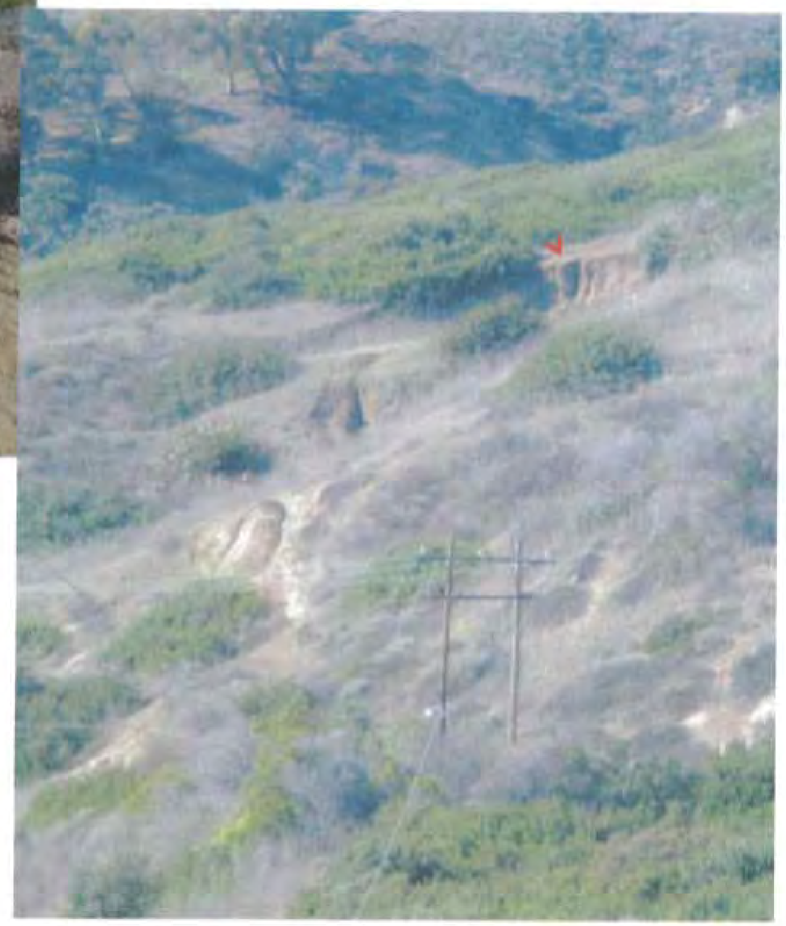
November 2008

The photo at right shows bike riders jumping off another cliff near the entrance to the Portuguese Bend Reserve, part of the Palos Verdes Nature Preserve. Again, they land on a heavily used, authorized trail at the base of the cliff.

The photo at left shows the beginnings of another trail being carved down a steep hillside.

Yet another example of trails carved by bicyclists over a steep cliff side and into habitat below.

Point of reference



The photo below shows a mountain biker who came off the jump pictured on the preceding page and is riding down the unauthorized trail network pictured in greater detail on the following pages. May 2009

The photos above show just part of the damage done by mountain bikes carving up the habitat and displacing fragile soils beneath the jump pictured in the preceding photos.

These photos show more of the damage beneath the jump pictured on the preceding pages.

A typical scenario: The rider (pictured right) came down from the unauthorized trail network pictured on preceding pages (hidden from much of the Preserve's authorized trail system), continued down the unauthorized trail below left, across the heavily used authorized trail (below right), and cut into the side brush as evident from the track in the photo below right.

He then looped back around to ride the same unauthorized trail network again within less than 10 minutes. May 2009

Not all jumps are high.

The photos above and at right show the two ends of a short trail formed off the primary, authorized trail. This type of trail made to take advantage of a particular feature in the Preserve is illegal, yet occurs repeatedly in the Preserve.

January
2007

Above is yet another example of a trail created up over a rise to the left of an existing, authorized trail, again putting at risk other trail users coming around the bend and damaging the natural contours of the land.

Despite rules put in place to prohibit this sort of thing, it continues.

Above, another unauthorized trail is being formed over a bump to the right of an existing , authorized trail. May 2009.

Not all jumps are naturally occurring.

These photos demonstrate how dirt piled on rocks, sandbags, wood and other filler can be built up to form doubles and triples, sometimes on a trail, sometimes off to the side.

Mountain bikers have carved numerous trails in the Preserve, down steep hillsides, over cliff faces, and over natural or built up "bumps" in an effort to add speed and technical challenges to their rides.

It may be fun for the mountain bikers riding such trails, but it has damaged plant life, intersected habitat, and created a safety hazard for users of the authorized trails. Above is another example of an unauthorized trail running down the hill (from the left), across the primary trail and on down the hill on the opposite side, creating a safety hazard for others.

These photos show another area of the Preserve that has many unauthorized trails, which continue to be heavily used by mountain bikers because they are technically challenging. In addition to the native vegetation here, what makes the area special are the area's unique geological features. Many of those features have been destroyed or irreversibly damaged by mountain biking.

Mountain bikes have caused irreversible damage to rock formations in the geologically sensitive pillow lava area of the Preserve.

The above photo demonstrates the trenching that can occur when a trail characterized by dry, powdery soil sees considerable use by mountain bikers. July 2009

Not all of the trails made by mountain bikers were intentional.

Some were made accidentally by mountain bikers who lost control and veered or skidded off trail.

Biker down.

At the point where the tracks go off trail in each of the photos below, there is a curve after a downhill section. Mountain bikers often fail to slow before the curves and ride off the trail.

All but one of the trails in the above network are illegal.

In the Palos Verdes Nature Preserve, there is an approved trails plan. Approved trails are marked to indicate which trails are available for use by equestrians, pedestrians, and/or mountain bikers.

New, illegal trails continue to be forged. July 30, 2009

Once a trail is formed, it's very difficult to close it off and return the trail bed to it's natural state. Closing off unauthorized trails involves a lot of work which is often thwarted by bikers' attempts to take back such trails. The photo below, left, shows one fairly successful effort to block access to an unauthorized trail, but it took several attempts and many hours of labor and the result detracts from the natural environment. In the rare instances that unauthorized trails are abandoned and have the chance to grow back spontaneously, what grows in place of the original, high quality native vegetation is oats and other non-native, invasive species, as seen below, right.

The riders in these photos came to this area on pedestrian equestrian only trails (marked "no bikes"), then rode down trails that are not in the approved trails plan, then rode into the habitat.

Riding down unauthorized trails , then into habitat.

. . . after seeing me, they
turn around.

I can hear the
vegetation being
crushed beneath them.

Mountain bikers riding down a trail labeled for pedestrian equestrian use only, no bikes.

July 30, 2009 at about 6 PM

Again, it is evident that they know they shouldn't be here. When they see me, someone says "she's got a camera" and they turn and ride down another trail.

These mountain bikers may think that they aren't doing any harm—that they are riding through a weed patch or "dead stuff." Much of the vegetation here is dry and brown and appears to be dead for a good part of the year. It is merely dormant. In addition, where there are patches of non-native "weeds," there is also a seedbed of wildflowers.

In these photos the wildflower known as Pearly White attempts to gain a foothold.

And of course there is other wildlife disturbed here. . . .

Humans and plant life aren't the only ones to be at risk when sharing the trails with mountain bikers in the Preserve. The photo at right shows a baby snake on a trail in the Preserve. (close up below)

Note the nearby bicycle tracks and consider what the likelihood is that the rider would see this little guy and be able to stop or veer away. Consider what the likely result would be if the snake had been a few inches further over to the center of the trail at the moment the bike passed by.

That baby snake was lucky.
These rabbits weren't so lucky.

Unsure about this one? See the next page.

The rabbit pictured below was found dead, just off to the side of a trail that winds down a hillside and is popular with mountain bikers. It appeared to have been hit with some force that likely broke its neck and knocked it into the dry mustard stalks just off the trail. There was no evidence that it had been attacked by an animal. Its fur was unmarred.

Another, this time a baby, found completely intact, just to the side of a trail at a bend where mountain bikes travel fast.

Some say maybe a fox or coyote attacked this little guy. If that were the case, wouldn't you expect the predator to have taken at least a little nibble?

Ask yourself where you would go if these mountain bikers were riding toward you fast on this narrow trail. It is not approved for bike use and yet mountain bikers ride here every day. This photo was taken one day when I was hiking with my two young daughters. These two mountain bikers were riding fast around a curve toward us. My girls were ahead of me at a point in the trail just beyond this which is a bit wider, so fortunately were not hit. On another occasion, on another trail, one on which mountain bikers are permitted, I wasn't so lucky. I saw the mountain biker coming and, when I had my back turned to him as I looked for snakes in the brush to see if it would be safe to step off the trail and out of his way, he sped by and hit me. I wasn't injured, physically, but what about the next time?

Several of the most vocal members of the mountain biking community have attempted to paint a picture of mountain biking that is much different from the way they engage in the sport. They want to paint it as a leisurely activity in which participants are out to enjoy nature. They want to paint a picture of families out riding together, as families might stroll through the hills on foot together. No doubt there are some mountain bikers who are content to ride in that manner. From what I've seen, more often than not, mountain biking is an aggressive, hard-driving sport in which participants challenge themselves and others to take on nature.

Those riders and that sport drive technology for increasingly sophisticated gear, with heavy duty shocks and tires to facilitate speed over difficult terrain and heavy duty protective gear for riders who fall. That technology is designed with the riders' needs in mind. It doesn't take into account the impact that increased speed and ability to be aggressive on trails has on other trail users.

It is vital that decision makers understand the impact mountain biking has on limited resources and it is vital that they understand that mountain biking, in general, brings an entirely different state of mind than that of most visitors to the Preserve and similar areas —those who come for the peaceful, tranquil setting away from the stress, intensity, and pressures of city life.

EXHIBIT E

Trail wars at Annadel State Park

8 comments related articles

By JULIE JOHNSON
THE PRESS DEMOCRAT

State Park Ranger Bob Birkland drove slowly, squinting into the early-evening sun as he crested a hill above the old Gordenker Quarry at Annadel State Park.

The 13-year Annadel veteran jammed on the brake, jumped out of the white state pickup and disappeared into a wall of gnarled manzanita brush. Several minutes later, he re-emerged.

Annadel State Park Ranger Bob Birkland pauses at an embankment of logs, branches and forest debris used mostly by mountain bike riders. "We need to give wildlife a break, they need a quiet area." referring to the proliferation of illegal trails. (Kent Porter / The Press Democrat)

“This is brand-spanking new,” Birkland said, gesturing behind him at a small opening in the brush. “This is a brand-spanking new illegal trail.”

Illegal trails, those carved out for off-trail sport or hiking, are becoming so common that they just about double the number of legitimate ones at 5,000-acre Annadel, park officials said.

The pace of the mountain biking boom, when combined with cuts to state park budgets, have crippled the efforts by park employees to effectively manage the demands of outdoor enthusiasts with those of mandates to protect the park.

Annadel officials say that bicyclists, who make up the dominant user-group at the park, are at the forefront of the move to to get off the marked trails and into the delicate ecosystems and archeological sites of the park’s hinterlands.

“People love the park so much, but they can love it to death,” Birkland said.

For cyclists, a ragged trail system in need of repair has lured people off sanctioned trails onto uncharted animal trails and overgrown roads left behind from generations of miners, ranchers and cobblestone quarry workers who worked the land before it was set aside for conservation in 1970.

“There’s a whole network of trails that are so much more pleasant to ride on,” said Jim Keene, longtime cyclist and general manager of NorCal Bike Sport and the Bike Peddler in Santa Rosa. “There’s a focus on law enforcement to try and stop the proliferation of illegal trails, but from my point of view, it’s a losing battle.”

About 44 miles of state-maintained trails wind through Annadel, a sprawling haven for outdoor enthusiasts that juts into Santa Rosa city limits.

If people are injured in an unmarked area, it can delay medical aid while rangers try to find them, Birkland said.

Ecologists have developed a science of trail building to minimize damage to ecosystems, said Cyndy Shafer, an environmental scientist with the state’s Diablo Vista District, which includes about a dozen parks in five counties, including Annadel.

Some areas are closed to contain the spores of sudden oak death pathogen. People who go off-trail at Annadel can carry the spores to unaffected areas of the park. she said.

When enough people go off trail, they can damage archeological sites, destroy endangered plants and cause erosion.

“The impacts can occur downstream of the parks as well,” Shafer said. “Sediment and soil in the creeks is natural to a point, but when you have an increased amount then soil actually becomes a pollutant to a creek.”

The park includes a rare, intact oak forest and is the home to numerous at-risk species, including the threatened California red-legged frog and an endangered aquatic grass, called *Sonoma Alopecurus*, Shafer said.

“So much land has been developed in California, the state parks are the refuges for a lot of species,” Shafer said. “Whether they’re threatened or not, the wildlife and vegetation in these parks are very important.”

Annadel is one of the few California parks where all trails except for a one-mile stretch, are multi-use trails, meaning people on horse, bike or foot can use them, said Birkland, the park ranger.

That has made it a destination for cyclists such as Linda Pomeroy, 49, and her fiance, 53-year-old Roger Lindsey, who headed up Canyon Trail for a two-hour technical ride navigating rocks, sharp turns, steep runs and single-track routes.

“I will fall sometime today,” said Pomeroy, who works for Catholic Charities and lives in Santa Rosa.

Armed with full-face helmets and squeaky horns to warn hikers and horseback riders of their approach, Pomeroy said she and Lindsay try to stick to sanctioned paths.

“A true mountain biker is also a conservationist,” Pomeroy said.

But evidence of other types of cyclists are plentiful. These are the people who ignore the “closed” signs posted on red fiberglass posts, who lug tools into the park to chop logs and dig up dirt to build jumps, ramps and other features for their hidden obstacle courses.

Birkland recently discovered a 2½-mile illegal trail running through a thick pine forest off the marked Lawndale Trail. Neatly cut logs formed multiple ramps, dead branches outlined a sharp turn and a pile of dirt created a steep jump.

“These guys are talking about not having a trail that’s aggressive enough,” Birkland said. “When you have 44 miles of trails built for you, why do you need to carve up your own?”

Down the path, Birkland spotted a man sitting on a fallen tree in a clearing. “Hello sir, are you aware you’re on an illegal trail?” Birkland called down to the man.

The hiker, startled, grabbed his walking stick and said he’d just stopped to rest. He headed back toward the trail.

Hikers and horseback riders also go off-trail, Birkland said. But bikers are are far more numerous and so their tracks are more damaging.

Keene, the cycle shop owner, said the state could have a legion of willing cyclists volunteer to help maintain trails if it wanted them. He compared it city officials who combat graffiti by inviting artists to paint murals. His businesses raised $4,000 for Annadel at a fundraiser party during the Tour of California.

“I don’t feel that most people would feel the need to build illegal trails if they had really good ripping trails in the first place,” Keene said.

Gov. Arnold Schwarzenegger last year cut the state park budget by $14.2 million, reducing maintenance and equipment replacement funds by 50 percent. His proposed budget for next fiscal year would restore those funds.

For now, though, the staff for the Sonoma Valley’s three state parks, Annadel, Sugarloaf and Jack London, have been cut in half, said Supervising Ranger Neill Fogarty. There’s often just one ranger on duty to patrol the three parks, he said.

Retired Ranger Bill Krumbein, who patrolled the park from 1973 to 1996 and wrote a book on the park’s history, is leading a campaign for passage of Proposition 21 on the November ballot. It would add $18 to vehicle license fees that would go to the parks.

On a recent morning hike, Krumbein, 66, turned off a mapped trail onto a single-track path that led into a meadow.

The bustle of hikers and bikers behind him, Krumbein paused to watch a flock of wild turkeys walk across the field of dry grasses speckled with the rare purple flowers of the Brodiaea genus, an herb unique to northern California.

“I see why people go off trail, it’s so calm,” Krumbein said.

The path then took a turn down the face of a hill and spread into wide, rock scramble where feet and wheels had pounded out the grasses.

“This used to be a hillside,” Krumbein said.

EXHIBIT F

PARK WATCH REPORTS
FOLSOM LAKE Pioneer Express Trail

NOTE: Every Park Watch Report is emailed to either the Head Ranger or Superintendent of the affected Park.

The database compiler has excerpted here the exact reporting language and the ID number of the Report. The identity of each person is restricted to the Park personnel or law enforcement who are working on that particular Report. If State Park administration to whom these Reports are provided would like to speak directly to any member of the public who made these Reports, the database compiler will provide the contact information, but would appreciate respecting the privacy of those who are reporting.

These Reports are from Folsom Lake SRA Pioneer Express Trail only, and only for the past 10 months. The Auburn SRA and some other parks have now been incorporated to the Park Watch system; Folsom Lake SRA was the pilot program. What follows is every report received regarding illegal trail use and conflict on the Pioneer Express Trail.

Please note that these reports are a very small fraction of the incidents on Pioneer Express Trail - these are only reports from people who know about www.ParkWatchReport.org and who take the time to report. There are some reporters who have become so disgusted with the repeated bad behavior of the mountain. bikers that they have ceased to report it, feeling it is a waste of time if the Parks can't do anything to enforce the Rules and Laws.

Pioneer Express Trail is the California State historic trail within the Folsom State SRA. Because of sheer drop offs, steepness, narrowness and lack of sight lines, it is limited to horses and hikers only. There have been injuries and deaths on this trail for the past fifty years, so safety is of high concern.

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REPORT #60
Brief description bike on horse/hiking only trail
Reporter's Activity Equestrian
Incident Date & Time Monday, February 22, 2010 12:30PM
Incident Type Trail Use Conflict
Description Mountain biker using most dangerous section of horse/hiking only trail
Incident Location Park / Region Folsom Lake SRA
Staging Area Sterling Pointe
Trail Pioneer Express Trail
Location Description 45 min so of Sterling Pt staging area. See Google map
GPS Coordinates 38.78848,-121.10941
=========
REPORT #70
Brief Description Signage Vandalism in Folsom Lake SRA
Reporter's Activity Equestrian

Incident Date & Time Sunday, December 20, 2009 1:30PM
Incident Type Suspected Illegal Activity
Description On Sunday, Dec. 20, 2009, between the hours of 1-3 p.m., the single post (4") with the brown state park metal sign reading NO BIKES which had been planted just beyond Mile Marker 38 going north toward Mile Marker 39 on the right side of the Pioneer Express Trail (equestrians and pedestrians only) was pulled from the ground. The sign was in place when I rode my horse past it at approximately 1:30 p.m., and it was gone when I returned on this trail at 2:30 p.m. There was a large pile of fresh dirt where the post had been pulled from the ground. I saw countless mountain bike tracks on the Pioneer Express Trail during my ride, but I encountered no bike riders.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Pioneer Express Trail
Location Description Just past the brown flexible trail marker at Mile
38.
GPS Coordinates 38.77307,-121.1292
==============
REPORT #71
Brief Description Mt. Bike ramp constructed on trail
Reporter's Activity Equestrian
Incident Date & Time Wednesday, February 10, 2010 11:00AM
Incident Type Trail Maintenance Issue
Suspected Illegal Activity
Description The teeter-totter ramp has been constructed on a state park trail. It is very large and visible, obviously constructed for the purpose of jumping with a mt. bike. It is built of 2x6 lumber and placed on the trail I assume for bikes to ride and jump on. There are also piles of logs nearby, collected and placed next to the bike trail. I assume since this is altering a state park trail, it is illegal. And unsafe to other trail users.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)
Location Description A mt. bike trail that parallels the main road into Granite Bay State Park is the location of this ramp. As you enter the park and drive to the horse staging area, there is a bike trail parallel to that road. If you ride out of the staging area on the paved road past the restroom and cross the main road, there is a bike trail just beyond
the big rock. The ramp is just to the left. It is built of 2x6 lumber and placed on the trail.
GPS Coordinates 38.75979,-121.14817
==========
REPORT #72
Brief Description Trail Conflict with Mountain Biker on Pioneer Express Trail
Reporter's Activity Equestrian
Incident Date & Time Sunday, January 3, 2010 3:00PM
Incident Type Trail Maintenance Issue Trail Use Conflict
Description On Sunday, Jan. 3, 20l0, between the hours of 3-4 p.m., I was riding a new horse on the Pioneer Express Trail (equestrian/ pedestrian use only). Between Miles 38-39, I encountered a male youth mountain biker. I yelled "HORSE UP!" and told the boy that mountain

bikes were not allowed on the trail and that he should exit the trail on the fork to his left which leads down to the Beeks Bight parking lot. The boy said he was just "checking the area out." I spoke loudly to the boy because I could see that he had an earphone (ear bud) in each ear, and I wanted to be sure he could hear me. A man and woman were close by, and the woman confronted me for yelling at her son for simply "going off trail." The boy's mother told the boy to pass my horse, but I refused to yield the trail to the biker by blocking the trail with my horse. My horse is not yet accustomed to mountain bikers passing on narrow trails, and I felt it was too dangerous. When the adult male said "Look bitch," and reached out as if to take hold of my horse's bridle, I told the man that if he touched my horse or caused a horse/bike accident, he and the boy's mother would both be sued. I said I was calling Park Dispatch to ask for a ranger to come to the site and settle the trail dispute. Upon hearing that I was calling for a ranger, the group dispersed. The flexible brown sign which is planted at the junction where the fork meets the Pioneer Express Trail has a bike symbol, but the red slash indicating "no bikes" has been removed by vandals.

Park / Region   Folsom Lake SRA

Staging Area   Granite Bay

Trail   Pioneer Express Trail

Location Description   This incident took place just a few feet from the brown flexible trail marker planted at Mile 38.5

GPS Coordinates 38.76942,-121.13354

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REPORT #74

Brief Description   Signage Vandalism in Folsom State SRA

Reporter's Activity   Equestrian

Incident Date & Time   Saturday, January 16, 2010 2:30PM

Incident Type   Suspected Illegal Activity

Description   I rode my horse on Saturday, Jan. 16, 2010, between the hours of 2:30-4:30 p.m. on the Pioneer Express Trail. Between mileage markers 37-40.5, I noted multiple fresh bike tracks. At mile marker 38.5, it is obvious that the bikers have cut the barbed wire fence and made a trail from the old Hoffman property (now state park owned) to the Pioneer Express Trail. From the visible bike tracks leading to the Pioneer Express Trail, it is obvious that this is one manner in which mountain bikers are gaining illegal access to the Pioneer Express Trail and riding towards Rattlesnake Bar. The mile marker at 38.5 appears old and sits off to the right side of the trail. It would be beneficial to replace this marker and place it in a more prominent position so that the mountain bikers cannot use the excuse that they did not see the sign with the symbol indicating "NO BIKES." I also noted that almost all of the flexible mileage markers between miles 37-40.5 have either had the symbol of the bike with a slash
through it completely peeled off or else the red slash through the bike has been peeled off giving the false impression that bikes are allowed on the Pioneer Express Trail.

Incident Location Park / Region   Folsom Lake SRA

Staging Area   Granite Bay

Trail   Pioneer Express Trail

Location Description   Pioneer Express Trail, Mile Marker 38.5

GPS Coordinates 38.76951,-121.13357

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REPORT #76

Brief Description teenage boys going into Park at Twin Rocks and Boulder Rd to create bike jumps
Reporter's Activity Equestrian
Incident Date & Time Tuesday, March 9, 2010 3:00PM
Incident Type Suspected Illegal Activity
Description Riding on trail heading West to Twin Rocks and Boulder Rd. Saw 6 teenage boys with shovels, clippers, etc. heading into the Park at old Hoffman Property entrance. Asked them what they were doing and they said' building bike jumps'. I said they were not allowed to do so and to turn around. They began mouthing off(f...ing this etc.) so I called Dispatch. Ranger Brad Cheshire arrived (after I made 2nd call because they were becoming belligerent).He informed the kids in no uncertain terms that they were not allowed to build bike jumps. They became belligerent with the Ranger which he handled well. Ranger Brad and I talked for awhile waiting for kids to leave and they didn't. I went to my barn at Los Lagos. Ranger left but said he would stay close by. Five minutes later, I encountered one of the boys again at the bike jumps and then they all showed up. I called Ranger again and he came out to the jump location and handled the situation. He will report the jump construction to Parks and get them removed...again. I have photos of the boys and the vehicle one of them came in.
Incident Location Park / Region Folsom Lake SRA
Staging Area (Unknown)
Trail (Unknown)
Location Description Twin Rocks and Boulder Rod, Granite Bay
GPS Coordinates
Suspected Illegal Activity
Type of Activity Illegal Trail Building Activity
Observation Saw Evidence
Activity Description Bike jumps were built at Twin Rocks and Boulder Rd on old Hoffman property. Witnessed the kids who constructed with their tools.
Reported To Name Ranger Brad Chesire
Reported To Phone Number (916) 358-1300
Reported To Agency State Parks
===============
REPORT #77
Brief Description Illegal mt. bike on Pioneer Express Trail to Avery Pond
Reporter's Activity Equestrian
Incident Date & Time Sunday, March 7, 2010 10:30AM
Incident Type Suspected Illegal Activity
Description While riding Folsom Lake Mounted Patrol on the Avery Pond at the bench Horse Trail Side. I talked to the Biker in the photo attached that he was on a hiking and riding trail only and the Trail is marked where he came in at the Overlook. He acted at first like he did not see the signs, but he acknowledged it after we had a nice conversation. I gave him a Park watch Card and pointed him to the next exit and asked him to walk his bike out. I did not call it in to the Park.
Incident Location Park / Region Folsom Lake SRA
Staging Area Sterling Pointe
Trail Pioneer Express Trail

Location Description To Avery Pond - on map
GPS Coordinates 38.8269,-121.09105
==================
REPORT #77
Brief Description Illegal mountain biking on Browns' Ravine/Old Salmon Falls trail
Reporter's Activity Other
Incident Date & Time Sunday, March 14, 2010 10:00AM
Incident Type Trail Use Conflict
Description Illegal mountain biker forced 2 female joggers off trail. Biker did not stop and walk his bike around joggers, as standard trail protocol requires, instead he caused them to step off trail in an area where there is a steep drop-off. This is a safety concern for hikers, joggers, and other trail users on this particular part of the trail.
Incident Location Park / Region Folsom Lake SRA
Staging Area Falcon Crest
Trail Browns Ravine to Old Salmon Falls
Location Description Near Old Salmon Falls Park, on trail immediately next to small planted pine tree forest, by homes on Falcon Crest Lane.
GPS Coordinates 38.75353,-121.06363
=================
REPORT #82
Brief Description encountered mountain bike on upper run trail in ASRA
Reporter's Activity Equestrian
Incident Date & Time Wednesday, March 17, 2010 3:45PM
Incident Type Suspected Illegal Activity
Description I encountered a mountain biker EB at the 13 mile marker(which is marked NO BIKES)about 2 miles east of Maine Bar and 2 miles west of the connection to the Brown's Bar trail. He had a white beard, was wearing a helmet and a green Cool Bike race shirt. He was polite but I told him he should not be on this single track steep drop-off trail clearly signed as not for bikes.
Incident Location Park / Region Auburn SRA
Staging Area Cool Staging Area
Trail Robie Trail to Brown's Bar
Location Description EB near the 13 mile marker(which is marked NO BIKES)about 2 miles east of Maine Bar and 2 miles west of the connection to the Brown's Bar trail.
================
REPORT #83
Brief Description Mountain bikes on trail where not permitted.
Reporter's Activity Equestrian
Incident Date & Time Friday, March 19, 2010 11:30AM
Incident Type Trail Use Conflict
Description While riding my horse I encountered mt. bikes 3 times on trails where not permitted. After talking with the bikers, it was apparent that they were indifferent to the potential danger.
Incident Location Park / Region (Unknown)
Staging Area (Unknown)
Trail American Canyon Loop

Location Description First on American Canyon trail, second on Browns Bar trail and third on the Robie trail.
=============
REPORT #104
Brief Description Mountain Biker Illegally Cutting Tree Limbs in Folsom Lake SRA
Reporter's Activity Equestrian
Incident Date & Time Thursday, April 8, 2010 5:45PM
Incident Type Suspected Illegal Activity
Description Violation of Calif. Code of Regulations 14 CCR, 4306(a). While riding my horse on an unnamed multi-use trail in Folsom Lake SRA, I encountered a mountain biker using a long-handled lopper to cut tree limbs on the edge of the trail. The mountain biker was a white male, approximately 20-30 years old. His riding helmet was black, and his mountain bike was blue and black.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)
Location Description The unnamed multi-use trail which crosses the park road which leads to the Activity Center in Folsom Lake SRA.
GPS Coordinates 38.75214,-121.14839
Suspected Illegal Activity
Type of Activity Illegal Trail Building Activity
Observation Observed Firsthand
Activity Description Violation of Calif. Code of Regulatios 14 CCR 4306(a).
On Thursday, April 8, 2010, at 5:45 p.m. while riding my horse on the unnamed multi-use trail, GPS Coordinates: Latitude 38.75214/Longitude -121.14839, I witnessed a mountain biker who had left his bike on one side of the trail while he used a long-handled lopper to cut tree limbs on the other side of the trail. His activity of pulling down the limbs to cut them and the sight of his bike lying on the other side of the trail spooked my horse. I told the mountain biker to stop the activity and return to his bike and stand the bike up so my horse could see what
was lying on the side of the trail which had spooked him. The mountain biker refused, saying that if my horse spooked, I shouldn't be riding on that trail. I decided to call for a ranger.
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REPORT #109
Brief Description Signage Vandalism in Folsom Lake SRA
Reporter's Activity Equestrian
Incident Date & Time Thursday, April 8, 2010 5:30PM
Incident Type Trail Maintenance Issue Suspected Illegal Activity
Description While I was riding my horse on a multi-use trail in the Folsom Lake SRA, a mountain biker speeding around a blind corner almost collided with my horse. The biker told me I was on a mountain bike trail and there were many fast bikes on the trail that evening, so I should not be on the trail with a horse. I told the biker it was a multi-use trail, and the bikers needed to comply with the speed laws and slow down on blind corners. The biker said, "Well, it won't really matter when you're lying on the ground with a broken back."
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)

Location Description Multi-use trail, GPS Coordinates: Latitude 38.75021; Longitude -121.1489
GPS Coordinates 38.75021,-121.1489
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REPORT #111
Brief Description Collision between me (trail runner) and Bicyclist on single track trail, et al.
Reporter's Activity Running
Incident Date & Time Thursday, April 29, 2010 4:14PM
Incident Type Injury to Person or Animal
Description As reported via phone to Officer McCollough, badge #1052. Report #210106701 @~909PM 4-29-10. I was trail running my usual course and about 5 minutes out of the Beeks Bight parking lot where the single track trail was less than 24 inches wide, curvy, heavily foliaged and without more than 10 feet forward visibility, I was struck from the front by a male bicyclist. It happen suddenly with a 1-2 second (or less) warning. His speed obviously well above 5mph and his position directly front of me on the narrow and blind trail. His left shoulder struck my chest area between my chest midline and left shoulder. There was no apparent contact between his metal
bicycle and me and no subsequent residual injury or pain to me at this time. He remained on his bike and came to a stop ~25 feet down trail. I immediately slowed to a near stop and reach for my camera phone in left short pocket. I mistakenly took a pic of myself instead of him amongst the confusion. There was no verbal communication from him. I did verbalize that I would be reporting the incident to Park Police and continued with my run. During this short ~5 to 10 second period another bicyclist appear, a female. I was at a near stop at that instant as she came into view then past me without contact. She was obviously exercising caution to avoid a second collision with me. It was then about 2-3 minutes later I decided to interrupt my run and phone the Park Police which I did @416PM.
Description of the male cyclist: White male, ~30y/o, slender built, likely tall, 6ft?. Wearing distinctively colored spandex (tank?) top, light pea/lime green and helmet (unknown color). His bike type/color unknown.
Description of the female cyclist: White female, ~30y/o, average height(?), not skinny but average weight, non-descriptive clothes, helmet and bike.

THEN another incident...~30 minutes later on the Middle trail. I was about halfway between the high lookout point (with 2 benches and a view of the dam) and the Boulder/Twin Rocks parking area. A cyclist suddenly approached me from behind. With little notice he yelled out "left". As in numerous prior instances the cyclist, without adequate trail clearance continued to verbalize his intent to immediately pass. I verbalized in return that he would have to slow down and wait for proper clearance to pass and not to make contact with me, if he did, I would report it to Park Police. In a clearly belligerent tone and while passing me, he additionally said that "I will remember you". This was,
without doubt, perceived as an intimidating threat to my safely. He then disappeared up trail just as fast as he appeared. Total time, 10-15 seconds.
Description: White male, 40ish, gray-white facial hair/beard, Non-descriptive helmet/bike, ~5'8", husky/fat build. Alone.
I ended my run @501PM, assaulted, threatened and frustrated once again. CAN YOU HELP ME?

Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)
Location Description First (primary) incident approx location marked on Google map below to the best of my ability. I should be able to pinpoint the spot in person, on location. Second incident on Middle trail approx halfway between the Lookout Overview (of the dam) and the Boulder/Twin Rocks Rd parking area.
GPS Coordinates 38.7679,-121.13001
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REPORT #115
Brief Description Illegal Trail Use
Reporter's Activity Equestrian
Incident Date & Time Sunday, April 25, 2010 5:20PM
Incident Type Suspected Illegal Activity
Description I rode my horse on the Pioneer Express Trail on Sunday, April 25, 2010, between 5:20-7:20 p.m.,the day following the American River Endurance Ride. I saw no bike tracks on the trail between the Granite Bay Horse Assembly Area and Mile 39.5. At Mile 39.5, I encountered a female biker with red hair entering the Pioneer Express
Trail from an opening in the Los Lagos fence. I asked the biker where she was going, and she said she was taking the trail to the lake. On my return home a short time later, I could see that the biker had not taken the trail to the lake. I tracked this single bike track to the junction just beyond Mile 38.5 where the multi-use and equestrian/hiking trails intersect.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Pioneer Express Trail
Location Description Mile Marker 39.5. Just before this marker, there is an opening in the Los Lagos fence which is wide enough for a single person to go through.
GPS Coordinates
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REPORT #116
Reporting About the Incident
Brief Description Suspected Illegal Activity
Reporter's Activity Equestrian
Incident Date & Time Thursday, April 29, 2010 6:20PM
Incident Type Suspected Illegal Activity
Description Multiple mountain bike tracks on Pioneer Express Trail (equestrian/hiking trail) between Mile Markers 37.0 to 39.5.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Pioneer Express Trail
Location Description Pioneer Express Trail between Mile Markers 37.0 and 39.5.
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REPORT #117
Brief Description Suspected Illegal Activity
Reporter's Activity Hiking
Incident Date & Time Friday, May 7, 2010 7:20PM

Incident Type Suspected Illegal Activity
Description Vandalism of signage in Folsom Lake SRA. The park gate and an equestrian/hiking trail sign showing NO BIKES have been vandalized with large stickers approximately 6" x 2" which read: BE CHANGE Oak Ridge Elementary School, extramilerun.com
Incident Location Park / Region Folsom Lake SRA
Staging Area (Unknown)
Trail (Unknown)
Location Description The entrance to Folsom Lake SRA at the corner of Twin Rocks Road and Boulder Road.
GPS Coordinates 38.767,-121.144
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REPORT #140
Brief Description No Bikes signs vandalized and stickers removed again
Reporter's Activity Equestrian
Incident Date & Time Sunday, June 27, 2010
Incident Type Suspected Illegal Activity
Description All the carsonite markers had the No Bikes signs stolen again, and paint was covering a No Motorized Vehicles sign.
Incident Location Park / Region Folsom Lake SRA
Staging Area Sterling Pointe
Trail Pioneer Express Trail
Location Description Trail from Sterling Pointe to Avery Pond
GPS Coordinates 38.82229,-121.10165
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REPORT #143
Brief Description Mt. bike almost hit horse
Reporter's Activity Equestrian
Incident Date & Time Tuesday, July 20, 2010 10:30AM
Incident Type Trail Use Conflict
Suspected Illegal Activity
General Comments Description On a trail that was straight with good vision a man on a mt. bike, who saw us riding horses, came speeding into us. My friend's horse jumped to the side. I told him he needed to slow down to give us the right of way. He then yelled at me to stay off of the trails.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)
Location Description Near twin rocks and the Park road
GPS Coordinates 38.76416,-121.1447
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REPORT #149
Brief Description Ongoing Night Mountain Bike Riding
Reporter's Activity Other
Incident Date & Time Wednesday, August 18, 2010 8:34AM
Incident Type Trail Use Conflict

Description A group of nine mountain bike riders using trails currently designated for equestrians using headlamps to navigate the trails -activity continued until after the state park was closed. (Past 9:00 p.m.)
Incident Location Park / Region Folsom Lake SRA
Staging Area Snowberry Creek
Trail Snowberry Creek Trail
Location Description Snowberry Creek Trail, Shady Trail and portions of the connecting Pioneer Express Trail.
GPS Coordinates 38.6535,-121.21099
Party Two Name 9 Night Mountain Bike Riders
Conflict Description At approximately 8:37 when I was doing rounds, (checking on horses, making sure all locks were locked, etc) a group of 9 mountain bike riders who were NOT adhering to trail speed limits were
riding on trails that are currently designated as equestrian trails. They had on head lamps and continued their ride from Shady Trail, to Snowberry Creek, then out to the Pioneer Express Trail. The following violations occurred in this one incident: 1.) Park usage after hours as established by the state park, 2.) Not adhering to speed limits
established by the state park, 3.) Riding bicycles on trails that are designated for hikers and equestrians.
Reported To Name Gold Fields District Dispatch
Reported To Phone Number (916)358-1300
General Comments This has been an ongoing activity for this particular group. We have advised trail users we know to exercise extreme caution as these people do not seem to be aware of how dangerous this activity is for
them and the people/animals they share the park with. It also causes significant erosion to the trails. I spoke with Folsom Lake Trail Patrol who indicated I should report this activity whenever I see it as there is interest in stopping this group from violating several park rules on a regular basis.
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REPORT #158
Brief Description bicycle on equestrian trail
Reporter's Activity Equestrian
Incident Date & Time Thursday, September 9, 2010
Incident Type Trail Use Conflict
Incident Location Park / Region (Unknown)
Staging Area (Unknown)
Trail (Unknown)
Location Description Folsom Lake Recreation Area, Snowberry Creek Area, approx 15 minutes from Shadow Glen stables
GPS Coordinates
Map Link fair oaks
=============
REPORT #161
Brief Description Illegal Mountain Bike Activity
Reporter's Activity Equestrian
Incident Date & Time Friday, August 6, 2010 2:00PM

Incident Type Trail Maintenance Issue
Suspected Illegal Activity
General Comments
Description In three different locations in the state park property called the Hofmann site (purchased from the Hofmann Company in 2000) mountain bikers have created illegal jumps and a trail.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)
Location Description Inside Folsom Lake SRA property known as the Hofmann site accessed at the corner of Twin Rocks Road and Boulder Road in Granite Bay, CA.
GPS Coordinates 38.76713,-121.14352
Type of Activity Illegal Trail Building Activity
Observation Saw Evidence
Activity Description Prior to 6-16-08: I saw, on a winter evening while riding my horse towards the Twin Rocks/Boulder Road entrance to the park, a car parked at this location with its headlights on. A group of
young adults (male and female) were standing around a very large hole being dug by one male. He was visible only from the waist up as he dug the hole. This site can be identified by the big blue automotive engines which have been dumped here. On 6-16-08: I found a mountain bike jumping grotto a short distance from the "big engine" site where I had watched a hole being dug during a previous winter evening. On 6-16-08, I saw a mountain biker using this second mountain bike illegal jumping grotto. I have photos of this biker in the grotto.
On 8-6-10: My husband and I filmed a quarter-mile illegal mountain bike downhill trail which is located directly across from Mile Marker 38.5 on the Pioneer Express Trail (equestrian/pedestrian only). The barbed-wire
fence separating the Hofmann site from the Pioneer Express Trail has been cut, and bikers access this downhill trail from the Twin Rocks/ Boulder entrance to the park. They ride to this trail, go downhill, and exit onto the Pioneer Express Trail. During the filming of this illegal trail, a mountain biker came down the trail and almost collided with me as I was walking uphill. The mountain biker said, "Howdy." When we reached the top of the hill, this mountain biker had ridden around and encountered my husband and myself. He asked if we were going to close the trail; he asked who we were "with" (what organization). My husband told him we were ordinary citizens. The mountain biker then said, "Well, the kids who made this will sure be disappointed; now they will have to go back and hang out on the corner." A copy of this film has been forwarded to Superintendent Ted Jackson.
General Comments
Comments The building of these illegal trails in the Hofmann site violates State Park Codes: 14 CCR/4319.Games and Recreational
Activities; 14.CCR/4307.Geological Features; 14 CCR/4306.Plants and Driftwood. Since there exists an Archaeological Survey Report for this site dated August 1980, this illegal mountain bike trail building
activity may also be in violation of 14 CCR/4308.Archaeological Features. In addition, the Final Supplemental Environmental Impact Report for the Hofmann site dated March 2, 1999, indicates that this 88.7 acre site
which was under consideration as Los Lagos Unit 3 is considered habitat for the Valley

Elderberry Longhorn Beetle (VELB), a species listed as a "threatened" species under the Federal Endangered Species Act by the U.S. Dept. of Fish and Wildlife Services.
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REPORT #165
Brief Description Vandalized Trail Signs along Pioneer Express Trail
Reporter's Activity Equestrian
Incident Date & Time Sunday, August 22, 2010 3:00PM
Incident Type Trail Use Conflict
Description Trail signposts along the Pioneer Express Trail in the vicinity of Milepost 37.7 (near Twin Rocks and Boulder Road)and proceeding north through markers 38 and 38.5 have been vandalized by mountain bikers. The symbol showing "no bikes" has been sandpapered off, peeled off, or scratched off so that red bar is not visible. Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Pioneer Express Trail
Location Description Pioneer Express Trail, proceeding north from the vicinity of Twin Rocks and Boulder Road in Granite Bay. This is approximately Milepost 37.7 and includes marker 38 and the trail junction near Beeks Bight.
GPS Coordinates 38.7665,-121.14394

Trail Use Conflict
Location of Conflict On the trail
Party One Myself
Party One Activity Equestrian
Party Two Activity Bicycle
Party Two Description one man in his 20s and two women in their 20s.
Conflict Description While riding north along Pioneer Express Trail, I was passed by three mountain bikers, despite the fact that this trail is closed to bikers. The bikers had to lift their bikes up and over wooden steps that serve as water-bars in the equestrian trail bed. I could tell from their unhappy comments that they were first-time users of the Pioneer Express Trail, and were unfamiliar with where they were going. I was going to point out that this trail is closed to bikes, but then I realized that the signposts had been vandalized. So I said nothing to them (since they were on unfamiliar trails and very annoyed with the uphill steps) and the important message on the signpost had been scratched off.
General Comments
Type of Comment Maintenance
Suggestion
Subject Trail
Comments It is suggested that equestrian trails (such as the Pioneer Express Trail) be marked with steel signs (not plastic) that read: "No Bikes" The red-slash symbol is not working and can be easily vandalized by bikers using sandpaper.
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REPORT #166
Brief Description Mt. biker, ignored requests to stop, rude, wouldn't stop in dangerous situation
Reporter's Activity Equestrian

Incident Date & Time Wednesday, September 15, 2010 11:00AM
Incident Type Trail Use Conflict
General Comments
Description We were in an area that mt. bikes and horses are allowed on a multi-use trail. We had 5 horses with 2 of them quite new to the trail. We asked the male bike rider to stop, yield and let us pass. He got angry and said horses were not allowed there and pedaled on. I said 2 horses were green and to STOP. He did not. One horse reared and another rider yelled at him again to stop. He then stopped for a few seconds and then went on. He was in his late 30s or maybe 40.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail (Unknown)
Location Description The loop by Doton Pt and Beeks Bight on the multi-use trail where bikes and horses are allowed.
GPS Coordinates
Type of Comment Other
Subject Other
Comments When mt. bikers do not slow down on multi-use trails, yield to horses and stop when requested, a dangerous situation like this can occur. Luckily, the riders were not thrown and hurt.
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REPORT #171
Brief Description bikes on horse hike trail
Reporter's Activity Equestrian
Incident Date & Time Sunday, September 26, 2010
Incident Type Trail Maintenance Issue
Trail Use Conflict
Description I ride in this area a lot. The trail markers are changed continually by people that switch the "no bike" signs to make it look like biking is allowed on that part of the trail. It is confusing to a lot of people. The trail is full of bike tracks, they are going to the Hoffman Los Lagos area near mile 38. I am reporting this because a lot of the bike people don't stay on designated trails, in many cases it is unsafe. I have seen many bike tracks under the No Bike sign that leads to the Pioneer Express trail .
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Los Logos Trail
Location Description near Los Lagos near mile 38 Pioneer Express trail
GPS Coordinates 38.76635,-121.1433
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REPORT #174
Brief Description While riding in Folsom Lake State Park (Hofmann property section) I came upon 5 young males working with shovels and rakes creating mounds, banks and channels for an unauthorized bike trail.
Reporter's Activity Equestrian
Incident Date & Time Thursday, October 28, 2010 2:30PM
Incident Type Trail Maintenance Issue
Suspected Illegal Activity

Description At approximately 2:30PM on Thursday, October 28, 2010 I was riding my horse at Folsom Lake SRA inside the Hoffman site off of Twin Rocks and Boulder. I was on the trail leading towards the back entrance to the Los Lagos Equestrian Center when I saw a young male, off to my right, standing with a shovel. I stopped my horse to observe him from a distance. After seeing me, the young male moved out of my line of sight. I proceeded down the trail a short distance and rode my horse cross-country to the location where I thought he was. I observed approximately 5 (maybe six) teen-age males actively engaged in building mounds, channels and banks to create an unauthorized bike jumping trail. They all had either a shovel or rake to perform this task. I informed them that this was illegal to do on State Park land and in fact was a fineable offense. They were quite belligerent and stated "We'll just pay the fine". I stated that they needed to take their equipment and leave the area. They refused to do so and yelled expletives at me. I told them that they could leave or I would call the park dispatch for a ranger. They again refused to stop their activity and leave the area. Unfortunately my cell phone did not have reception at that location. I called 911 to request that I be patched through to the Folsom Lake SRA dispatch but they would not do so since this situation was not life threatening. I pretended to call dispatch and again told the young males to stop their activity. They responded with "Ok, so you are just telling us to go and do drugs". They then started to disperse and I followed them out toward the Pioneer Express trail. I became unable to pass through the area with my horse and turned to go back the direction I came in from. When I got back to Boulder road the young males were
standing at the back of an SUV stowing their shovels and rakes. I proceeded to an area where I could call dispatch from my cell phone. There were no Rangers available but I was told that one would return my call. At approximately 5:00 PM. Ranger Darren Parker called and agreed to meet me at the Twin Rocks and Boulder location. We walked into the Hofmann site and he observed the illegal bike mounds and channels. He took some photos of the mounds. The next day, Friday October 29th, I walked back into the area with a friend who was aware of illegal bike trails at the Hofmann site discovered in 2008. These trails with mounds had been cordoned off with orange plastic fencing by the park in 2008. This was the same general area where the new activity was occurring. We saw that the fencing had been rolled up and thrown into a pit off of the illegal trail. Upon surveying the area where I had observed the building of illegal bike trails the day before, we discovered that the trail was much more extensive than Ranger Darren Parker and I had observed. I called dispatch and was told that Ranger Cheshire would meet us at Twin Rocks and Boulder. At approximately 1:35 PM he walked in with us and observed the entire new bike jumping trail.
Incident Location Park / Region Folsom Lake SRA
Staging Area (Unknown)
Trail (Unknown)
Location Description Closest intersection of roads: Twin Rocks and Boulder in Granite Bay. Inside the section of Folsom Lake SRA that is known as the Hofmann site. Incident occurred in the area between the Pioneer Express trail and the trail to the left of the Pioneer Express trail which leads to the Los Lagos trail.
GPS Coordinates 38.76713,-121.14352
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REPORT #178
Brief Description No bike symbols missing, defaced, painted over and gone
Reporter's Activity Equestrian

Incident Date & Time Saturday, November 6, 2010 2:00PM
Incident Type Trail Maintenance Issue
Description The trail from Granite Bay Assembly area and to the parking lot beyond Twin Rocks Road. All along the Pioneer Express trail the no bike symbol/signs have been painted over, torn off, the strike has been scratched off, or symbol was completely gone. A man and his son where on the Pioneer express trail (just before Twin Rocks) When informed of he not suppose to be on the trail - He responded that was the way to the wonderful jumps that have been created just off of the Pioneer Express Trail. He said that they were the most amazing jumps he has seen! He and his son had just come from the area and came down Pioneer Express Trail to get to their car at Twin Rocks. 15:00 Pioneer Express Trail between Vogel Road Access and Granite bay area. When the boy was told he was not
supposed to have a bike on the trail he said that he thought it was a trail for motorcycles. The trails need to have all the symbols replace/repaired/enforced.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Pioneer Express Trail
Location Description 2 occurrences today - One right between Los Lagos gate entrance and Twin Rocks (they had been on the illegal jumps which have been created on the property closest to Los Lagos. The second was a boy behind Vogels boarding property, and the boy said he was under the impression that he was on the motor bike trail. Both these incidents involved bike riders and extreme speeds. Very Dangerous when coming onto a horse and rider at these speeds and they were miss informed of the trail usage.
GPS Coordinates 38.76719,-121.14125
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REPORT #182
Brief Description 9 bike riders going about 15 miles an hour on the
pioneer express trail
Reporter's Activity Equestrian
Incident Date & Time Wednesday, November 17, 2010 7:25PM
Incident Type Suspected Illegal Activity
Description 11/17/2010 7:25 PM - I saw 9 bike riders (together in a group, single file, speed racing) traveling on the Pioneer Express Trail from Twin Rocks Road toward Granite Bay Staging Area. It was quite dark they had head lights. I told them that they were not suppose to be on the trail, it was for Walkers and Horse riding. One of the men responded they would look out for horses as he sped down the trail without any hesitation.
Incident Location Park / Region Folsom Lake SRA
Staging Area Granite Bay
Trail Pioneer Express Trail
Location Description The path that runs along Vogel Valley Road from Twin Rocks toward Granite bay staging area.
GPS Coordinates 38.76076,-121.14937
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REPORT #184
Brief Description 16:55 Two bike riders on Pioneer Express Trail
Reporter's Activity Equestrian
Incident Date & Time

Incident Type   Suspected Illegal Activity
Description   11/20/2010 There were 2 bike riders in Spandex riding their bikes on the Pioneer Express Tail. When told they were not to be on the trail they said thank you and kept on their way. They were riding in the direction of Granite Bay Staging area coming from Twin Rocks Road trail opening
Incident Location Park / Region   Folsom Lake SRA
Staging Area   Granite Bay
Trail   Pioneer Express Trail
Location Description   11/20/10 4:55 PM I saw 2 bike riders (in Spandex) single file (one right after the other) riding at dusk with head lights on Pioneer Express Trail - heading to Granite bay Staging area (coming from the entrance at Twin Rock Road trail head).
GPS Coordinates 38.76058,-121.14974
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NOP Comment Letter O-5

EXHIBIT G

California Equestrian Trails & Lands Coalition

June 2005

Safety Considerations for Multi-use Trails

CET&LC is continuing to develop specific design and enforcement standards for proposed and designated multi-use trails. The primary concern of our member organizations regarding multi-use trails is the safety of these trails for equestrians. The recent need (since about 1985) for multi-use trails is primarily to accommodate the addition of mountain bicycle use. **In order to safely accommodate bicycles that travel much faster than equestrians or hikers, specific trail design standards and safety guidelines are required to provide safe use for all.**

The CET&LC represents most organized recreational equestrian groups in California with 46,000 members. It is estimated that there are over 400,000 recreational riders in California. Many of these people ride trails as part of their recreational enjoyment.

The CET&LC offers general comments on conditions necessary to make the trail use experience positive, safe and enjoyable for all users. Also included is a set of **Trail User Guidelines** for issuance to every user at the trailhead.

1.   From the equestrian user’s perspective, mountain biking use has become a safety issue and needs to be addressed on all trail conversion decisions, as well as new trail construction, to help alleviate the conflict among users. The CET&LC supports multiuse trails where appropriate. In recent discussions with California State Parks staff in Sacramento on how best to define safe practices that will allow users to continue enjoying multiuse trails, we have recommended a number of safety provisions. The term “appropriate” means trail portions where terrain and slope do not limit the safe passage between equestrian and bike users. Inappropriate trails should not be designated multi-use until corrected. CET&LC is committed to working with State Parks, other agencies and other users to develop a set of safety guidelines that is acceptable to all users.

2. Some users have commented that it is a “perception of safety” when considering conversion of trails to multi-use. To the equestrian community, it is more than a perception; it is a true evaluation of the safety circumstances, including the likelihood of increased risk to other trail users. Speed by other users is a major problem for horses, especially around blind or limited visibility curves. Trails can be designed to mitigate this problem, coupled with additional training for equestrian animals. It still remains that the primary user for which speed is part of the use is the mountain biker. If all users were to travel no more than 4 to 5 mph, as most trails are designed to be used, then most of the interface problems would be solved. Horses react to fast moving objects with their natural instincts and can only be trained to a point. Equestrian users have asked why should a well established user group be asked to significantly retrain their animals to meet a user that has brought a completely new use to the trail system? CET&LC is committed to developing a set of safety guidelines that all users can accept as long as the users consider the innate survival reaction of the horse. We accept the need to accustom our animals to meet bikers on multi-use trails so long as the biking community will do the same in adjusting their use patterns accordingly. The enclosed draft safety guidelines should be accepted by all agencies as part of the trail plan; otherwise, it is predictable that conflict will continue. Often, in defining the conflict problem, it seems that the emphasis is focused on equestrian “behavior” rather than a focus to resolve problems by urging all the users (bikers, equestrians and hikers) to work together for a solution.

3. In the new update of the State Park Trail Policy there is reference made that "design, education, signage, and enforcement can be effective in controlling conflict." The CET&LC totally supports this approach, and our member organizations in California join in this support. Noted below is what was recently presented to the California State Parks Director and Staff:

Design Considerations:

a. **Develop a set of trail construction standards** that take into consideration each user's needs. Obviously, these will have compromises but will use safety as the primary objective. Some specific suggestions are:

- Visibility: Switchbacks and curves need 50 ft visual clearance on either side so users can see others.
- Trail width: Wide trails can create maintenance and drainage problems. This topic includes old roads and whether they should continue to be used and be an exception. Some agencies consider wide trails as an erosion problem. Forest Service believes bikers and equestrians will often ride side by side if the trail is too wide, while many equestrians consider a 6 ft wide trail as a minimum in order to safely pass cyclists.
- Trail slope: Keep slope as low as possible (< 12% if possible) for safe places for passing and visibility.
- Separate Trails: Where terrain is steep, visibility is limited and safe passage is hazardous, consider having separate parallel trails, one for equestrians/hikers and one for mountain bikers.

b. **Line Of Sight**: Visibility is a major factor in the safety issue. Switchbacks and blind curves severely limit all users. Limited visibility reduces reaction time of trail users to gauge other user's speed and control so as to move out of the way where possible. Limited visibility also reduces the user seeing others approaching from behind or in front, thereby not slowing nor giving a warning call before reaching them.

c. **Trail Width - Slope & Drop-off**: Safety on narrow trails requires that one be able to move off the trail to avoid an accident. If there is no way to go up a steep slope or if the drop-off is too extreme, one literally has nowhere to go. Blind curves and switchbacks in conjunction with narrow trails along sides of mountains with steep drop-offs and slopes increase the chances of accidents when trail users of different speeds are using the same trail.

d. **Startle Factor**: Cyclists are relatively silent and can appear suddenly thus startling and alarming others. On narrow trails with reduced line of sight, the risk of collision between fast approaching, silent cyclists and other users rises dramatically.

~~e.~~ **Trail Grade**: This factor is directly proportional to the downhill speed of some users. There does not appear to be incidents among the users when bicyclists are going uphill. Cyclists going downhill are sometimes not able to stop in time to avoid startling horses

f. **Trail Surface**: Surfaces that are slippery with sand or excess scree diminish traction for most users and raise the chances of injury. When such a trail is also narrow, or has no escape route or reasonable visibility, it becomes a hazard for multiple users.

g. **<u>Quality of Outdoor Experience</u>**: Safety and peace of mind should be a primary consideration in establishing policies for multi-use trails. Policies should enhance the positive experiences that outdoor recreation provides. For most, the trail experience is a relaxing endeavor. Mountain biking, requiring a vehicle, is fundamentally a different experience from hiking and horseback riding. These experiences may be compatible where there is sufficient physical trail space to allow each user a sense of freedom and safety without interference. However, when physical space diminishes on a trail, then compatibility disappears and conflict intensifies. Perceived risk becomes real for hikers and equestrians, and injury is a predictable experience. Thus, when the quality of a trail experience is markedly reduced, many will choose to not repeat it to avoid the possibility of conflict. They are then displaced or disenfranchised from enjoying a quality trail experience.

Education:

a. The education of trail users is a key factor in the creation of a safe trail system for all to use. Not everyone understands the nature of a horse or appreciates the incredible survival skills with which they are born. We are offering to develop some suggestions for all trail users to adopt as a way of increasing the comfort level of both the trail horse and non-equestrian trail user.

b. The education of the equestrian user is also a vital area for multi-use trails. The CET&LC is recommending to its member organizations to improve the "startle factor" training of riders and animals as part of the adjustment to becoming multi-use trail users. Several Equestrian Clubs have adopted training clinics to teach the horses and riders to meet cyclists in varying situations. This greatly improved the animal's awareness that a cyclist is not a threat. However, even with training, "sudden appearance situations" requires an exceptional horse to handle and is not in the usual scope or ability of many equestrian trail riders (reference Police and Sheriff Posse training and horse dropout ratio).

Signage:

The CET&LC is recommending that California State Parks and other agencies with trail systems adopt the classic triangle yield sign as a standard for all multiuse trails. Enclosed with this letter is an example of the sign used by several other States, as well as some California park systems. It works quite well to alert users to a certain protocol and trail etiquette when meeting others on multi-use trails. Likewise, there should be good signage to make users aware of who is permitted or not on various trails.

Enforcement:

Having an enforcement process is vital for today's multitude of users. There is reference to volunteer patrols in the pending State Parks Trail Policy, but no mention is made of law enforcement; and that is a critical element in maintaining a safe recreational environment. If State Parks or any other agency adopts multiuse trails over special use trails, some type of rules enforcement on the trails must be in place and will need a significantly high priority.

Conclusion:

CET&LC is recommending for all trail system users the guidelines listed above as a way to make riding, hiking and biking an enjoyable trail experience. As stated before, our intent is to support multi-use trails as long as the safety concerns and terrain conditions are addressed. **If an existing trail cannot meet these standards, then it should not be designated multi-use.** CET&LC looks forward to working with all user groups and agencies in developing safety guidelines.

GENERIC SAFETY GUIDELINES FOR MULTI-USE TRAILS

1. The Future

The way we use the trails today shapes trail access for tomorrow. Please do your part to enhance our multi-user access and image by observing the following Safety Guidelines for the Trail.

2. Always yield to other trail users.

Let your fellow trail users know you are coming. A friendly greeting or gesture is consideration of others and that will go a long way towards cooperative trail use. Don't startle others. Show respect when passing by slowing to a walking pace. Anticipate other trail users around blind corners or in areas of poor visibility. Yielding means slow down, establish communication, follow the yield protocol and be prepared to stop if necessary to pass safely.

If you need to pass a horse and rider, either from behind or from the front, slow down and alert the rider you want to pass on the downhill side. Give the rider time to take control and move the horse. If a horse needs to pass you, dismount or stand on the downhill side.

When groups of users desire to pass from the rear, be courteous, convey your desires and wait for the slower users to determine a safe passing point.

3. Right of Way Protocol - Reference to Yield Triangle Sign

When trail conditions require a right of way for safe passage, equestrian users have the primary right of way, hikers next and then cyclists. When trail conditions allow and when there is width to safely pass, common courtesy should prevail for all users.

4. Control your Actions.

Awareness of trail conditions at all times is vital for safe use. It is recognized that the level of training and experience of any user varies and it is your responsibility to be in control. If you and a mount, cyclist, or hiker is inexperienced on the trail, it is suggested you travel with other trail users with more experience. Travel only at a speed that is safe for conditions on the trail.

If you see a horse shying or spooking, move away from the horse and keep talking. Speaking will help the horse relax and realize you are a person.

5. Safe Speed

Excessive speed is an unsafe use of multi-use trails. All users must use good judgment and be aware that there are other users on the trail who may be going slower than they are. Limited visibility around corners and curves should be a signal to slow down to the speed of hikers, the slowest trail users.

6. Plan ahead.

For safe use of trails, know your ability and the area in which you are riding, hiking or cycling, and prepare yourself accordingly. Be self-sufficient at all times. Keep your animal & equipment in good shape and carry necessary supplies for changes in weather or other conditions. A well-executed trip is a satisfaction for you and not a burden to others.

7. Awareness of Equestrian Safety

If you or your siblings would like to pet the horse on the trail, first ask the rider if it is OK. Horses are very social animals and follow specific social rules with each other. We humans get along best with them when we act as they do.

Other Trail Considerations

8. Use open trails only.

Respect trail & road closures. Use a map, and contact agencies if uncertain about the trail. Avoid trespassing on private land. Obtain permission, permits or other authorization as required. The way we utilize the trails today will influence trail management and practices in the future.

9. Leave No Trace. Practice Gentle Use Principles.

Be sensitive to the earth beneath you. Recognize different types of soils & trail conditions. Wet & muddy trails are more vulnerable to damage, so consider other options. Please stay on existing trails; do not create new ones and do not shortcut. Be sure to pack out all that you pack in.

10. Be Aware of other animals.

Give other animals, both domestic and wild, extra space and time to adjust to you.
Running cattle or disturbing wildlife is a very serious offense. Leave gates as you found them or as they are marked.

NOP Comment Letter O-5

EXHIBIT H

UNITED STATES OF AMERICA

FEDERAL REGULATORY COMMISSION

In the matter of	)	March 31, 2006
	)	
State of California	)	Docket No. P-2100, P-2100-052
Department of Water Resources	)	
	)	
For a New Major License	)	
Oroville Division, State Water Facilities	)	

NOTICE OF MOTION, MOTION TO INTERVENE, PROTEST AND COMMENTS
OF
ACTION COALITION OF EQUESTRIANS, BACK COUNTRY HORSEMEN OF CALIFORNIA, CALIFORNIA EQUESTRIAN TRAILS & LANDS COALITION, CHICO EQUESTRIAN ASSOCIATION, EQUESTRIAN TRAIL RIDERS, EQUESTRIAN TRAILS INC., GOLDEN FEATHER RIDERS, INC., OROVILLE PAGEANT RIDERS, PARADISE HORSEMEN'S ASSOCIATION, AND CONCERNED INDIVIDUALS

The organizations and individuals identified herein hereby notify FERC and the parties to the above action of this motion to intervene in that action pursuant to Rules 212 and 214 of the Rules of Practice and Procedure of the Federal Energy Regulatory Commission ("FERC"), 18 C.F.R. §§ 385.202, 385.212, 385.214, and 380.10 (NEPA and environmental compliance) and provide comments in the above-captioned matter. Further, Intervenors by this document protest the manner in which the licensee conducted the Alternative Licensing Process ("ALP"). This intervention, protest and comments relate to the application of the State of California, Department of Water Resources ("DWR") for a new project license to continue to operate the Oroville Facilities[1] (the "Project"). Intervenors specifically intervene to oppose approval of and seek modification of portions of the Settlement Agreement filed March 24, 2006, and the

[1] The Oroville Facilities (FERC Project No. 2100) also have been known during the life of the project as Feather River Project and Oroville Division, State Water Facilities.

December 2005 Draft Settlement Agreement Recreation Management Plan ("RMP")[2] and related environmental assessments.

I. PROJECT BACKGROUND

A. DESCRIPTION OF PROJECT

The existing dam and hydroelectric facilities at Oroville were developed as part of the California State Water Project, to provide a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The purposes of the State Water Project are to store and distribute water to supplement the needs of urban and agricultural California water users, flood management, power generation, water quality improvement in the Sacramento San Joaquin Delta, recreation, and fish and wildlife enhancement. DWR currently operates the Project under a license issued by FERC on February 11, 1957, which will expire on January 31, 2007. In January 2005, DWR filed an application with FERC for a new hydroelectric license for the Project to continue generating hydroelectric power while maintaining existing commitments and complying with regulations pertaining to water supply, flood control, the environment, and recreational opportunities.[3]

B. GEOGRAPHICAL AREA AFFECTED BY THE PROJECT AND RECREATION RESPONSIBILITIES

The Project is located on the Feather River in the foothills of the Sierra Nevada in Butte County, California. As detailed in other interventions already filed in this matter as well as in Project documents, the project lands are owned by a variety of State and Federal agencies.

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[2] Intervenors are aware a March 2006 Draft Settlement Agreement Recreation Management Plan became available to the public, at the FERC eLibrary, on Thursday afternoon, March 30, 2006. It has not been possible for us to compare the December 2005 version to the March 2006 version in detail. A quick review of those pages of interest to Intervenors suggest sat least in those areas there are no changes in the March 2006 document. However, all references to the "RMP" in the present motion are to the December 2005 version, selected pages of which are included as Exhibit A.

[3] See Preliminary Draft Environmental Assessment , Department of Water Resources, January 2005, [hereinafter PDEA], at Introduction, 1-1. Selected pages are attached as Exhibit B.

In 1961, the Department of Water Resources ("DWR") transferred recreational interests and management responsibility for the 23,000 acres within the Project boundary to the California Department of Parks and Recreation ("DPR"); these lands form a majority of the Lake Oroville State Recreation Area ("LOSRA").[4] DWR also transferred about 12,000 acres to the California Department of Fish & Game ("DFG") but reserved any interest necessary to construct, operate, and maintain the Project; these lands constitute much of the Oroville Wildlife Area ("OWA").[5]

DWR has delegated much of the responsibility for recreational management of the land underlying and surrounding Lake Oroville and its facilities to DPR; however, as FERC notes in an August 2000 letter to ORAC, DWR is "ultimately responsible for the construction, operation, and maintenance of all Commission required recreation facility and recreation areas, and for implementation of the project approved recreation plan."[6]

Within LOSRA and the immediate surrounds there are approximately 75 miles of recreational trails, including the 21.5 miles of traditional hiking-equestrian trails.[7] The traditional hiking-equestrian trails provide a unique trails experience that is of great value to the Intervenors as well as to the general public.

II. <u>STANDARD FOR INTERVENTION</u>

Under 18 C.F.R. § 385.214(a)(3), any person seeking to intervene to become a party may file a motion to intervene. The Intervenors are considered to be "persons" and are therefore qualified to intervene under § 385.214(a)(3).

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[4] *Id*.
[5] *Id*.
[6] Letter from Lon Crow, FERC, to Tres Hobbie, ORAC, dated August 17, 2005, pg. 2, Exhibit A1.
[7] From the RMP, Exhibit A, page D-12, Table D-2, "Proposed trail use designation changes and new trails in the project area." Years ago DPR told local equestrians the traditional hiking-equestrian trails constituted 17.5 miles, and they have used this figure in their documents. The RMP indicates there are approximately 21.5 miles of hiking-equestrian trails. Although Intervenors are unclear as to the actual miles of the original hiking-equestrian trails since there has never been a detailed mapping of the trails, for purposes of this motion, Intervenors use the RMP figure of 21.5 miles.

Pursuant to 18 C.F.R. § 385.214(b)(2), in order to intervene, the motion must demonstrate:

a. The movant has a right to participate which is expressly conferred by statute or by Commission rule, order, or other action;
b. The movant has or represents an interest which may be directly affected by the outcome of the proceeding, including any interest as a :
    i. Consumer,
    ii. Customer,
    iii. Competitor, or
    iv. Security holder of a party; or
c. The movant's participation is in the public interest.

The Intervenors are equestrians, hikers, and mountain bikers. It is in the public interest that moving parties, who represent a significant segment of the public users of Project 2100 recreational facilities, be permitted to intervene in this matter. Some of the Intervenors have been actively and directly involved in the planning and public input elements of the Alternative Licensing Process ("ALP") used in Oroville since that process began in 2000. In some instances, Intervenors were living in the Oroville area and/or using the area for recreation at the time of the original license in 1957. The Intervenors, therefore, have an interest which will be directly affected by the outcome of the proceeding, and the Intervenors' participation is in the public interest.

Specifically, the Intervenors, along with other members of the public, have used and enjoyed the unique trails experience provided by the historic hiking-equestrian trails. The proposed conversion of those trails under the December 2005 Recreation Management Plan (the "RMP") will have a direct and negative impact on Intervenors and the public, as is detailed in Section V. below. These negative impacts and adverse potential or actual negative environmental effects of any trail conversion have not been studied or evaluated by the licensee.

In fact, there is no project description of any trails conversion which would make it possible to perform any environmental review under NEPA or CEQA.

Since the Intervenors meet the regulatory requirements to intervene, their motion should be granted.

Intervenors are also impacted by the failures, errors and omissions in the ALP itself, including the failure to include in any document clearly defined and enforceable accounting and budgeting provisions in the draft settlement agreement and recreation management plan documents, to ensure that the state can or will carry out necessary assessments, enforcement and financing of their proposed recreation management plan.

III. INTRODUCTION TO AND SUMMARY OF POSITION OF THE PETITIONERS

The Intervenors seek to protect and preserve a unique trails experience, the 21.5 miles of traditional hiking-equestrian trails within LOSRA. The longest of the trails, the Dan Beebe Trail, was dedicated in 1963, at the same time construction of the Oroville dam began. The Roy Rogers and Loafer Creek Trails were completed in 1989 to bring the hiking-equestrian trails to their current configuration. The hiking-equestrian trails were developed and have been maintained by community volunteers working in collaboration with state agencies.[8] They were maintained as hiking-equestrian trails under the current license until very recently.

In 2002, DPR unilaterally converted these hiking-equestrian trails to multi-use, adding bikers to these trails; then DWR retroactively filed a request to amend the then in place Recreation Management Plan. We opposed that conversion, filing a motion to intervene on June 6, 2003. FERC reviewed our motion and concurred that there was no justification for converting

[8] Exhibit C includes a 1963 newspaper article describing the dedication of the Dan Beebe Trail along with a 1978 article on trail maintenance.

the trails under the existing license. As summarized in the January 21, 2005 Order denying Rehearing:

> "[T]he project area currently offers a balance of recreational opportunities for trail users. … [M]aintaining trails within the project for use by equestrians and hikers offers a unique recreational experience worthy of preservation. In addition, shared used of trails increases safety concerns and user conflicts…"[9]

The June 2003 motion to intervene is attached as Exhibit D to the current motion along with the August 17, 2004 and January 21, 2005 FERC orders related to the proposed amendment to the approved Recreation Management Plan [Exhibits E and F, respectively].

The Oroville community, including some of the present intervenors, has participated in an involved, extensive and time consuming relicensing process. At no time during that process has there been a clear explanation of why the hikers and equestrians who currently have access to a unique and valuable trails experience should give up that resource, just because DWR and DPR and the national mountain bikers lobby want to give bikers access to the traditional hiking-equestrian trails.

Never in the ALP process has there been a user group consensus that this conversion of the traditional trails occur. The only user study -- undertaken by DPR, while the trails were out of compliance and bikers had been using the hiking-equestrian trails -- did not demonstrate a need for the conversion. There were no baseline studies of the hiking-equestrian trails prior to their unauthorized conversion to multi-use or since that time. There is no evidence that any such conversion would be safe for users or the environment. Moreover, the same user safety issues raised in our June 2003 intervention continue today and have never been addressed.

As FERC itself found in the Order Denying Request to Amend Recreation Plan:

[9] Order Denying Rehearing, Issued January 21, 2005, Federal Energy Regulatory Commission, Project No. 2100-129, pp. 3-4, attached as Exhibit F.

> "[C]onverting the trails to multiple use (with bicycles sharing the trail) would adversely change the recreational experience for equestrian users primarily because it may increase the potential for user conflicts and necessitate more trail maintenance and modifications to accommodate the multiple uses. Through research of the trails and trail uses in the region of the project, we identified many trails available to mountain bikers. The approved recreation plan designated special use trails for equestrians to provide a unique recreational experience."[10]

And from the Final Environmental Assessment accompanying that Order:

> [T]he proposed action is likely to increase impacts on many more miles of trails as competing trail users would have to share trails at the same time. This is likely to decrease trail safety, increase user conflicts, and necessitate more trail maintenance and modifications.[11]

The conditions and realities of multi-use on the traditional hiking-equestrian trails are the same today as they were when many of the current intervenors opposed their conversion in 2003. Issues of safety and preserving the unique trails experience mandate against converting these traditional trails.

Intervenors are not categorically opposed to multi-use trails. We have supported a variety of trails experiences, including some multi-use trails within LOSRA. However, we strongly oppose the conversion of the traditional hiking-equestrian trails. See for example, the Oroville Pageant Riders February 9, 2005 letter, attached as Exhibit G. Those intervenors who have participated in the trails planning processes have also recommended a separate single-track bike trail as a way to increase biker trail access without harming existing trail users or increasing the environmental damage caused by bikers on these historic single-track trails. As is described below, DWR itself accepted that proposal as an "Interim Project" in 2002. A newspaper article from the time is attached as Exhibit H.

[10] Exhibit E, at page 5.
[11] Ibid, pg. 28.

Intervenors herein and in their previous intervention, opposing the unsafe and unilateral conversion of these same traditional, historic, hiking-equestrian trails, assert that it is impossible to convert the existing historic, traditional trails.

They cannot be rendered safe through reconstruction, new construction or otherwise, for multiple use pursuant to recognized engineering safety standards including the State's own trail maintenance standards. It is inherently impossible to add bikers to these sensitive trails without increasing environmental damage.

These trails represent decades of community involvement and volunteerism, bringing generations of users, young and old, to enjoy the unique recreational experience these historic, traditional hiking-equestrian trails provide. Such values should not be sacrificed through any conversion of this small portion of the overall trails system in the LOSRA area. Adding bikers would eliminate most hikers and equestrians from these trails.

IV. DESCRIPTION OF INTERVENORS

Intervenors include several Butte County equestrian clubs as well as other organizations. Many of the local clubs have been or remain members of the California State Horsemen's Association, "Region 2". Intervenors note that none of the local clubs other than CSHA Region 2 signed the Draft Settlement Agreement.[12] Some club and individual CSHA members have or are considering resigning from CSHA due to Region 2's and former president Robert Gage's support of the proposed conversion of the traditional hiking-equestrian trails.

[12] Settlement Agreement for Licensing of the Oroville Facilities, State of California, Resources Agency, Department of Water Resources, FERC Project No. 2100, March 2006, Exhibit G, pgs 1-2.

The California Equestrian Trails & Lands Coalition ("C.E.T. & L.C.") is comprised of several equestrian groups[13]. Representatives from all member clubs except the California State Horsemen's Association have voted that C.E.T. & L.C. sign this motion.

Intervenors also include community members and other individuals active as hikers, mountain bikers and/or equestrians. All intervenors share a concern that the historic hiking-equestrian trails in Oroville represent a unique and valuable recreational resource that deserves to be protected, now and in the future.

V. PROTEST AND INTERVENTION.

A. PROTEST: THE ALP PROCESS AT THE OROVILLE PROJECT HAS BEEN BIASED AND FLAWED, RESULTING IN FLAWED RECOMMENDATIONS THAT DO NOT REPRESENT A CONSENSUS OF COMMUNITY USER GROUPS.

The major problem with the ALP, in this case, appears to be that the licensee has unlimited power to enforce its own agenda. The attitude toward the development of public recommendations and agreements appears to be that of a bad Alternative Dispute Resolution philosophy, "You know you've succeeded when everyone involved is unhappy." The licensee has manipulated and controlled the so called stakeholder mediation process to the end of accomplishing a settlement agreement and attendant management plans which promote and achieve the licensee agency's agenda and goals without regard for the other stakeholders. In this instance the equestrian and hiking trails are proposed to be converted to multi-use with only an

[13] Action Coalition for Equestrians, Backcountry Horsemen of California, California State Horsemen's Association, Equestrian Trails, Inc., Marin County Horse Council, Pacific Coast Quarter Horse Association, Palos Verdes Peninsula Horsemen's Association, Recreation and Equestrian Coalition, Sonoma County Horse Council are members of C.E.T. & L.C.

undefined, unfunded, and empty promise of a review of any such conversion, at some unknown time, prior to effecting such a conversion.

The inequity of the process is one reason why the Intervenors hereby file this intervention.

1. The ALP was not a fair or reasoned process of mediating differences to achieve a consensus. The licensee agency (in this case two agencies DWR and DPR) manipulated the process to achieve their agendas.

Some of the intervenors have participated in trails planning as part of the ALP process since it started. Although others may have had what they consider a positive experience with the ALP, those of the Intervenors who have been an active part of the recreation planning process since 2000 have had a very different experience.

There has been a consistent pattern of a volunteer group's coming to consensus on a proposal then having that group disbanded and replaced by another group. Despite these community recommendations, DWR continued with the ulterior motive of hiking-equestrian trails conversion. Finally with the 2004 Trails Focus Group, DWR claimed to have gotten a recommendation to convert the trails although, as detailed below, at least some participants do not recall such a recommendation from the Trails Focus Group.

In 2001, a few months after the ALP process began, it was clear that there was some disagreement about trails planning and trail use in the Project area. The trail users were told they were to solve it themselves. In response to that FERC directive, a group of trail users, without agency participation, met under the aegis of the "Recreation Interim Task Force". Then Feather River Parks District Supervisor Bob Sharkey volunteered to facilitate the meetings. The group achieved consensus, recommending that there be a new separate bike trail. Conversion of the hiking-equestrian trails was not a part of the plan. The last meeting of this group was a joint meeting with the Lake Oroville Bicycle Organization ("LOBO"); of the eight or so LOBO members attending, all but one, Lyle Wright, agreed with the proposal to establish a separate bike trail. LOBO was to write to DWR and DPR supporting these separate trails. Later, we learned that DPR and DWR had met with LOBO and told them that additional single-track trails for mountain bikes were never going to happen.[14]

This plan, which had biker, hiker and equestrian support, was brought back to the Recreation Interim Task Force which approved it and forwarded it to the Recreation and Socio-Economic Work Group which also approved it, showing the bike trail among the top ten priorities.[15] From there it went to the Plenary Group where once again the proposal to add a separate bike trail was approved; **converting the hiking-equestrian trails was not part of the proposal**. The proposal was then presented to and accepted by DWR as an interim project proposal in February 2002. Ironically, side by side with the newspaper article reporting DWR's decision accepting the bike trail interim project is another front page detailing a DPR decision. In this case, it is article announcing LOSRA Superintendent Kate Foley's decision to open all the LOSRA trails to multi-use, **in spite of the input of users to preserve the traditional hiking-equestrian trails**. See Exhibit K.

At the same time that the Interim group was working, the Joint Powers Authority ("JPA") hired Peter Dangermond, a recreation planning consultant, to facilitate a Trails Task Force, essentially duplicating the work of the Interim group. Many of the current intervenors volunteered for this group as well even though they recognized there was an obvious duplication of effort. The consensus report from this group to the Joint Powers Authority was a recommendation for a separate mountain bike trail. **There was never a consensus to convert**

[14] See declarations of Janine Cody, Exhibit H, and Robert Weinzinger, Exhibit I.
[15] Recommendations to the Recreation and Socioeconomics Work Group, October 25, 2001, Exhibit J, cover sheet, pages 1-5, 10.

the hiking-equestrian trails to multi-use. JPA approved the recommendation to go forward to DWR, actually including proposals for several new multi-use trails along with a dedicated bike trail while preserving the traditional hiking-equestrian trails. [See Exhibit L attached, the 2001 Dangermond Committee report]

In 2003, DWR asked Peter Dangermond to convene another trails planning group for the purpose of developing protection, mitigation and enhancement measures ("PM&Es"). They provided a recommendation similar to the 2001 group though by this time, with DPR's unilateral multi-use conversion, the hiking-equestrian trails were increasingly controversial.

The FERC-mandated Oroville Recreation Advisory Committee ("ORAC") confirmed its support for this JPA–Interim Project plan in a March 17, 2003 letter to FERC:

> "The ORAC supports multi-use trails, and is in favor of building additional trails in the project. … The ORAC **does not support the conversion of the Dan Beebe Trail, the Loafer Creek Trail and the Roy Rogers Trail to multi-use. … The ORAC is in favor of the single-track mountain bike trail plan as approved by the Plenary Group as an interim project. …The ORAC has taken extensive public input on the subject of trails use for over 8 years.** This is well documented in ORAC's minutes which are in FERC's possession.**"**[16]

Despite the clear and consistent work of two volunteer groups and the FERC-mandated ORAC clearly recommending a separate bike trail and leaving the traditional hiking-equestrian trails as they were, DWR and DPR continued on their own agenda.

In 2002 DPR unilaterally undertook the unauthorized conversion of the hiking-equestrian trails to multi-use. It is the Intervenors' impression that the unauthorized conversion of the traditional hiking-equestrian trails had a major role in allowing DWR/DPR to put these trails

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[16] Letter from Wade Hough, Chairman, ORAC, to Magalie Salas, Secretary, FERC, dated March 17, 2003, Exhibit M, pg. 1.

more visibly on the table as negotiable rather than protected as a part of the existing recreational facilities to be "continued to be maintained" as guaranteed by the 1993 Recreation Plan.[17]

In 2004, FERC ordered DWR to return the hiking-equestrian trails to their original configuration and remove biking as an inappropriate use. FERC reconfirmed this order in January 2005. DWR/DPR agreed to comply. And, DWR convened yet another trails planning group, despite the years of effort and consistent recommendations of prior working groups and ORAC to add a single-track bike trail and leave the hiking-equestrian trails alone.

In Fall 2004, DWR created the "Trails Focus Group." As described by Mark Andersen, Chief, Oroville Facilities Relicensing Branch, DWR, DWR wanted to sit down and determine "with each user group/interest having an opportunity to propose dedicated trail use ideas, and to ultimately determine **if there are specific exceptions to the 100% multi-use trail approach that most or all users can agree on.**"[18]. Suddenly all Project trails were to be converted to multi-use, unless there was a specific reason to except such a conversion.

At the second meeting of this group, participants were separated into two working groups, basically divided along equestrian-hiker and biker lines. Each group was given a mylar map on which to mark their recommendations for the trails. The group facilitators took the proposals and returned with two mapped proposals at the third meeting. Equestrian participants in the process believe that their proposal was grossly misrepresented. Janine Cody raised the issue that the map was incorrect; she was told that it was incorrect but the facilitators did not change the mapping. This working group did not achieve consensus.

At this third meeting there was a vote of the members, with votes distributed among the hiker-equestrian, biker, and a hybrid equestrian-biker-hiker third alternative which some meeting

[17] "Proposed Amended Recreation Plan for Lake Oroville State Recreation Area", Department of Water Resources, June 1993, pg. xi [Exhibit N].
[18] Email from Mark Andersen to Cathy Hodges, dated September 23, 2004, Exhibit O.

participants demanded be considered, even if it was not accepted as a formal option. The intervenors who participated in these meetings are clear there was to have been a fourth meeting of this group on November 30, 2004, to come to an agreed-upon final recommendation. That meeting was cancelled by DWR. See declarations of Janine Cody, Robert Weinzinger, and Annette Kolkey, Exhibits H, I and P. DWR instead brought forward its own proposal, which is represented in the December 2005 RMP, converting the majority of the traditional hiking-equestrian trails to multi-use.

There are many more examples of a flawed and manipulated trails planning process. The status of the trails was a part of the settlement negotiations. In August 2005, Intervenors asked to bring their proposal for a blend of multi-use, biking and hiking-equestrian trails to the settlement negotiations table. They were told by the group facilitator that they would have to get significant support from the other group members before any such proposal would be considered. The proposal was presented at the September 2005 Settlement Negotiations meeting. ORAC followed up on behalf of the Intervenors, stating they found the proposal "consistent with the principles for Trails that ORAC from inception has supported for fair and balanced recreation experience for all trail users, while maintaining consistency with environmental and safety requirements." Despite ORAC's support, as well as support from the four local horse clubs, for the equestrian-hiker proposal, DWR went forward with its recommendation in the RMP that the hiking-equestrian trails be converted. The conversion proposal clearly lacked broadly-based support; nonetheless it went forward. There was no further opportunity for those intervenors active in the settlement negotiations to have input. A key December 14, 2005 meeting of the settlement negotiation group regarding recreation was cancelled. The facilitator instead convened a "by invitation only" meeting of some of the interested parties to discuss the recreation elements of the settlement agreement.[19] Intervenors were not invited to that meeting.

DWR now presents its December 2005 Recreation Management Plan, claiming that it has broad community and user group support. It has been promulgated despite workgroup and ORAC recommendations that a single-track bike trail be added and that the hiking-equestrian trails be preserved. Since the RMP was issued in December 2005, ORAC has filed a lengthy letter providing its comments and recommendations on Project 2100 recreation matters. ORAC's comments on the trails provide an excellent summary of the efforts to preserve the trails:

> "For several years ORAC, DPR and the Licensee have been devoting great expenses of meeting times and resources to guarantee unique hiking, equestrian and biking experiences on Project lands. FERC's Order issues January 21, 2005 to return the trails to the 1994 order was in response to the proposed 2002 CDWR-DPR trail amendment for Multi-use. The Commissions ruling upheld the original trail designs and found that mixing biking with equestrian-hiking use dangerous and unnecessary for the 2100 Project. There is more than sufficient land resources available to insure a unique trail experience for each.
>
> "We recommend the current trail system be continued into the new license except for a very short transition section where user trails may overlap be designated multi-use. We further recommend the Demonstration Mountain Bike trail agreed to in the interim projects be developed either on Project lands or property Pacific Gas & Electric could make available." [20]

Recently California State Senator Sam Aanestad, 4th District, has added his voice, once again drawing into question DWR's claim to broad public support for the conversion of the traditional hiking-equestrian trails. He first identifies several concerns and questions about the ALP process. He references the more than 1300 signatures on petitions to preserve the

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[19] See Exhibit Q, email dated December 22, 2005, from Anna West, Kearns & West [settlement group facilitators] to Cathy Hodges.

[20] Letter from Kevin Zeitler, Chair, ORAC to Magalie Salas, Secretary, FERC, dated January 27, 2006, pg.8, Exhibit R.

traditional trails[21] along with support from local and state horse clubs. Sen. Aanestad comes to the conclusion that "the public is not being listened to" at the Oroville Project. [22]

From the Intervenors' perspective, this proposed trails conversion does nothing to enhance the recreational resource. It creates unsafe and inappropriate multi-use trails with the result that hikers and equestrians **lose** access to a unique and valued trails experience.

2. DWR and DPR Brought Their Own Agenda and Bias to the ALP Trails Planning Process.

When the ALP began, DWR published a relicensing newsletter. It continued for five issues, from June 2001 to December 2002. In the Winter 2002 issue, Mark Robinson, Director of the Office of Energy Projects at FERC is quoted, describing how an ALP should work:

> "If members of the public see that they have an opportunity to change things and that their concerns are listened to, then the licensee is able to develop a sense of good will among the community. That sense of good will is important when you have issues come up in the future and you need the public's trust to respect your decisions about the project."[23]

Very early in the ALP process, Intervenors realized that the licensee had its own agenda and that their concerns were not being taken seriously. There are several examples of the bias that intervenors who volunteered in the planning process experienced.

DPR leadership involved in the Oroville facilities has discounted the value of public input. During the period when the traditional hiking-equestrian trails were illegally converted to multi-use, then Superintendent of the California Department of Parks and Recreation for the Oroville Project 2100 area State Park, Kate Foley (retired) who authorized the trail conversion was questioned:

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[21] Oroville Pageant Riders filed some of these petitions with FERC on January 30, 2006 and has since collected additional signatures. See FERC Doc. No. 20060131-0048.
[22] Letter dated March 21, 2006, from Sam Aanested, Senator, 4th District, to Director Lester Snow, Department of Water Resources, pg 2, attached as Exhibit S.
[23] Oroville Facilities Relicensing News, December 2002, "FERC Official Discusses the Alternative Licensing Process," pg. 2, Exhibit T.

> "[County Supervisor] Josiassen asked Foley if she held public hearings before changing trail policy. …**Foley said no, and that public hearings tend to end up in arguments like this meeting, she said, and decisions don't get made.**
>
> **"'Public hearings tend to be unproductive," Foley said. "We wanted it to be a more professional decision making process.'"** July 13, 2002, Oroville Mercury Register, pp. 1A, 11A; emphasis added.[24]

The Trails Focus Group which DWR claims provided a trails plan acceptable to users as well as to DWR and DPR had as its agenda "**to identify exceptions to multi-use**".[25] This was not a group organized to continue to provide the existing recreational facilities as promised in the 1993 Recreation Management Plan. As detailed above, it did not achieve consensus on a trails recommendation.

Intervenors join with Butte County in questioning the thoroughness and validity of the licensee's economic studies. In the "Recreation Activity, Spending, and Associated Impacts Final R-18" study published in May 2004, one finds the following assumptions about recreation spending:

- "Visitation patterns and recreational activities at the Oroville Facilities in the future will generally follow existing patterns.
- "Future visitor spending patterns will remain similar to current patterns."[26]

In the same study, the authors estimate total "existing" recreational spending per year in the area at $30,672,200.[27] In the year 2020, they project an increase to $38,778,200[28], approximately 1.6% per year.[29] Such modest growth suggests there are no plans for significant enhancements to the recreational facilities at Lake Oroville, enhancements that would attract tourists and

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[24] Exhibit D, pg. 5.
[25] Exhibit O.
[26] Recreation Activity, Spending, and Associated Impacts Final R-18, Department of Water Resources, May 2004 , pg. 4-2, Exhibit U.
[27] Ibid, pg. 5-2.
[28] Ibid, pg. 5-15.
[29] Intervenors assume the "existing" data point is 2003, based upon the report publication date of May 2004. In fact, the data may well be based upon an earlier time point since statistics collection is often delayed; if such is the case, the growth projections would be even more discouraging.

increase recreational revenues. These dismal growth projections are despite the projected major increase in potential recreation users as more and more baby boomers retire.

For another example, in their work to protect their unique hiking-equestrian trails, equestrians had meetings with Ruth Coleman, Director of DPR. One of those meetings involved Janet Peterson of Action Coalition of Equestrians and Equine Industry Lobbyist Bob Fox. Ms. Peterson recalls that Ms. Coleman had no interest in the history of the trails, saying something like, "I don't care how the trails got on the ground." She also wrote off horses as a "dying breed." As Ms. Peterson remembers it, her comment was, "Quite frankly, horses do not figure into our future plans."[30] That is a rather remarkable view of an industry where the recreation component contributes some $32 billion to the national economy each year, $1.9 billion of that contributes to California's economy.[31]

B. MOTION TO INTERVENE AGAINST PORTIONS OF THE DRAFT SETTLEMENT AGREEMENT FILED MARCH 24, 2006. UNDER THE NEW LICENSE, ONLY SIGNATORIES OF THE DRAFT SETTLEMENT AGREEMENT MAY PARTICIPATE ON THE PROPOSED RECREATION ADVISORY COMMITTEE.

The intervenors recently confirmed that the draft settlement agreement which has now been filed, and the associated RMP, exclude anyone who disagrees with its terms from any further official participation in the next 50 years of planning activities. In exchange for signing the agreement, the parties are bound never to put before FERC a criticism of the licensee without first being released from the settlement agreement by the licensee agency itself in a separate and undefined dispute resolution procedure. As Rick Ramirez, DWR Program Director for the relicensing, recently put it in an email to one of the intervenors, "signing the agreement provides

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[30] Personal communication from Janet Peterson, March 22, 2006.

[31] "Most Comprehensive Horse Study Ever Reveals a Nearly $40 Billion Impact on the US Economy, June 28, 2005" United States Equestrian Federation, Inc., highlighting the July 2005 Study of The Economic impact of the California Horse Industry and The Economic Impact of the Horse Industry on the United States which were sponsored by the American Horse Council and conducted by Deloitte Consulting LLP, website, printed 3/28/2006 www.usef.org Exhibit V.

the group with committee status but it also obligates the organization to defend the agreement before FERC."[32]

The statewide California State Horsemen's Association has been very supportive of preserving the traditional hiking-equestrian trails. For example, in August 2005, the CSHA State Trails Chair wrote to ORAC, saying:

> "These [traditional hiking-equestrian trails] were designed for riders and hikers, with steep sections, many blind corners and switchbacks. As hiking and equestrian trails, they offer a wonderful and unique recreational experience. CSHA strongly supports keeping these as hiking and equestrian trails. Converting them to multi-use would make them unsafe and unpleasant for many hikers and equestrians."[33]

Intervenors are unclear as to why, given statewide CSHA's strong support for the traditional hiking-equestrian trails, statewide President Bob Adams signed the Settlement Agreement. We can only guess that the draconian elements of the agreement led him to believe that if he did not sign it, CSHA would be excluded from sitting at the table to plan Oroville trails and recreation opportunities for the next fifty years.

Some of the terms of the Settlement Agreement[34] are quite remarkable. For example, Section 2.1 Purpose states:

> "The parties have entered into this Settlement Agreement for the purpose of resolving all issues that have or could have been raised by the Parties in connection with FERC's order issuing a New Project License. **While recognizing that several regulatory and statutory processes are not yet completed, it is the Parties' intention that this Settlement Agreement also resolves all issues that may arise in the issuance of all permits and approvals… including but not limited to ESA … NEPA and CEQA."**

And, having agreed to environmental analyses before they are complete, signers of the Settlement Agreement further agree, in Section 4.2.1.2:

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[32] Email dated March 8, 2006, from Rick Ramirez to Janine Cody, Oroville Pageant Riders, Exhibit W.
[33] Letter dated August 3, 2005, from Bob Svedeen, C.S.H.A. State Trails Chairman, to Kevin Zeitler, Chair, ORAC, pg. 1, Exhibit V.
[34] Settlement Agreement, pgs. 6-7, 9, 14, Exhibit G.

> "No party will use any Material New Information generated in the environmental review, public comments, or otherwise in this relicensing process to revisit the compromises inherent in this Settlement Agreement for the purpose of improving its bargained-for benefits."

Section 4.6.1 Support for Issuance of New Project License constrains the signers' ability to propose elements outside of the Settlement agreement:

> "To the extent permitted by applicable law, all Parties shall support and advocate through appropriate written communications to FERC…this Settlement Agreement and the PM&E measures stated in Appendix A hereto…[T]he parties agree not to propose, support, or advocate proposed PM&E measures, or license conditions Inconsistent with this Settlement Agreement."

Finally, from the Settlement Agreement - RMP, only signers are authorized to participate on the proposed Recreation Advisory Committee, which is proposed to replace ORAC.[35] Based upon their experience with the process, Intervenors believe the purpose of replacing ORAC is to create a recreation planning committee more amenable to the DWR/DPR agenda, including trails conversion.

Intervenors do not believe that the future recreation planning process can be effective when dissent is not allowed. That is one reason why no local equestrian clubs signed the Settlement Agreement. California State Horsemen's Association Region 2, which has or has had local horse clubs as its members, is a signer along with state CSHA. However, none of the local equestrian clubs that are, or were until they resigned in protest, CSHA members support the Settlement Agreement. They cannot support an agreement that continues to put forward the flawed recommendation that the major portion of the traditional hiking-equestrian trails be converted to multi-use.

[35] Exhibit A, pg. 4-18.

The intervenors ask that FERC remove the draconian provisions of the draft settlement agreement that would exclude Intervenors from future trails planning as members of the RAC, simply because they did not sign the Draft Settlement Agreement.

C. MOTION TO INTERVENE AGAINST THOSE PORTIONS OF THE RECREATION MANAGEMENT PLAN THAT PROPOSE CONVERSION OF THE TRADITIONAL HIKING-EQUESTRIAN TRAILS. THERE IS NO LEGITIMATE BASIS FOR THE CONVERSION OF THE TRADITIONAL HIKING-EQUESTRIAN TRAILS TO MULTI-USE.

In the Recreation Management Plan, DWR proposes to convert parts of each of the original hiking-equestrian trails. From the December 2005 document, which appears to be the same for the relevant pages as the just published March 2006 document:

> "6.5.9 Dan Beebe Trail
> "Proposed Actions and Enhancements:
> Most of the Dan Beebe Trail is proposed to be opened to bicycle use, with the exception of the steep segment over Sycamore Hill."[36]
>
> "6.5.12 Loafer Creek Loop Trail
> "Proposed Actions and Enhancements:
> Most of the Loafer Creek Loop Trail is proposed to be opened to bicycles and designated for multiple use. An exception to the multiple-use designation will be a segment in the vicinity of the Loafer Creek Equestrian Campground, which will remain closed to bicycles."[37]
>
> "6.5.16 Roy Rogers Trail
> "Proposed Actions and Enhancements:
> To provide bicyclists with access from the Loafer Creek Campground to the Saddle Dam area, where the Bidwell Canyon Trail begins, the licensee proposes that the westernmost segment of the Roy Rogers Trail be designated multiple use."[38]

Intervenors find no basis for these proposed conversions which will destroy the unique trails experience available to hikers and equestrians. The safety of all users would be threatened. The bikers' use of the trails would add to the environmental damage caused while these traditional hiking-equestrian trail illegally converted. There are many miles of trails available to

[36] RMP, pg. 6-38.
[37] Ibid, pg. 6-39.
[38] Ibid, pg. 6-41.

bikers in the Lake Oroville project without destroying the unique and valued hiking-equestrian trails.

1. Under the 1993 approved Recreation Management Plan, the Oroville Community was assured that the existing recreational facilities would continue to be provided. Converting the hiking-equestrian trails eliminates a unique and valued user resource.

The approved 1993 Recreation Plan states that the recreational facilities described within that document will "continue to be maintained in the future."[39] On a simplistic basis, adding bikers to single-track hiking-equestrian trails does not eliminate the trails themselves. However, such an addition changes the fundamental experience and safety of those trails in the same way that converting a country lane to a highway changes the users and their experience. In the present case, conversion would mean adding vehicles[40] to a trail previously only used by pedestrians and horses.

Converting these trails, built years ago for hikers and equestrians and not designed for multiple-use, would not create "shared" trails; rather the trails would be dominated by speeding, irresponsible and indifferent bikers. Too many bikers do not obey speed rules or rights of way. In fact, when accidents occur, many bikers do not stop to assist, they speed on their way, often with curses and insults against the equestrians or hikers they have injured.

Many equestrians report that when trails are converted from hiking and equestrian use to multi-use, they no longer feel safe on those trails and stop using them. Here is just a sampling of their comments. These and others are included in Exhibit Y.

"The conflicts in Annadel Park with bikes are ongoing. The Mounted Assistance Unit has to double up patrols on weekends because of the massive number of bikes – which keep a lot of Equestrians from using the Park on weekends. Annadel narrowed trails and made them unsafe with a lot of bike and other user conflicts. They had to widen trails to make them safe. Now

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[39] Proposed Amended Recreation Plan for Lake Oroville State Recreation Area, pg xi, Exhibit N.

[40] California Public Resource Code Section 42165. "**Vehicle**" means any device used for transportation. "**Vehicle**" includes **bicycles**, airplanes, and other transportation devices not used on highways, and automobiles and other vehicles, as defined in Section 670 of the Vehicle Code. [emphasis added]

people do not ride as much on weekends because bikes have taken over Park. China Camp in Marin is an example of a Park that Equestrians do not use anymore because of tremendous bike usage." Michael Murphy

"As a community member, I was asked by a Sacramento county supervisor in 2003 to serve as her appointee to the American River Parkway Plan Update process. This 'promised' one-year volunteer involvement has lengthened into a 2 ½ year project, which is not finished yet!

"During this process, the Update Committee has devoted considerable time to discussing the possibility of admitting Mt. Biking into the Parkway, causing me to research Mt. Biking activities in other areas. Included in my research has been reading large parts of the 'City of LA Recreation & Parks Dept. Mt. Bike Access working Group Majority Report, September 15, 2000.'

"This very revealing report included dated and signed testimonial letters from individuals and groups across the United States about the dangerous and frightening episodes they've experienced with Mt. Bikers. Most have declared that due to these traumatic experiences, they HAVE CHOSEN TO NOT USE THE TRAILS THEY ARE ENTITLED TO USE because they fear for their safety, their group's safety, and often times, for the safety of their horses. What were once designated as 'Multi-Use Trails' have now become 'Single Use Trails' - being used by Mt. Bikers only.

"Additionally, I am a member of the California Native Plant Society (CNPS), Sacramento Valley Chapter. In February 2006, the CNPS representative from the Sacramento Valley Chapter to the American River Parkway Plan Update Committee officially notified the management staff that our chapter is strongly opposed to introducing Mt. Biking into the AR Parkway because of wide-spread concerns about damage to the native habitat – both plant and animal, erosion factors, soil degradation, etc. due to the inability to restrict Mt. Bikers to defined trails." Peggy (Margaret A.) Berry

"I have ridden horses on this trail since the 1970's. I have had several negative experiences with mountain bikers while riding my horse on "multi-use" trails. My experience has left me with the strong feeling that horses (and hikers for that matter) are not compatible using the same trails with mountain bikers. I have had a couple of close calls, and if I had not been a strong rider with a well trained horse, there would have been collisions. As a hiker, I've also had to jump off a trail to avoid being hit by speeding downhill mountain bikers." Stephanie Sager

"Sirs, I am requesting that you consider strongly the equestrian population of this north state area in your relicensing process. The number of horses and riders in this area grows every day and needs for accessible, safe areas for planned and unplanned events are very limited. Many of my associates have all but given up on riding at the Orville (sic) area due to the unfriendly and unsafe practices of the majority of bicyclists that frequent the trails. As with Bidwell Park, in Chico, the 2 wheeled populace has all but destroyed the area set aside for horses. Ever meet a biker coming down a narrow trail as fast as he can with nowhere to run? Well, I have, and believe me, the options are grim. Most sensible horses used on trails will shy away from bikes because of their speed, rattling and banging, and the rocks they throw." Peggy Eldridge

"I have also had bikes come over a hill nearly missing my horse and badly spooking her. She is very trail wise, but even the most settled horse will, at times, react when startled. There are many inexperienced riders and horses not used to being out on the trails, which could, and has, led to disaster for both horse, rider, and/or bicyclist. Because of the fact that I do not have to dodge bicyclists, the rides on the beautiful 17 miles of dedicated trails at Oroville are relaxing, enjoyable, and safe." Karan Jo White

"My brother and I spend some part of our summers hiking on trails in the North Yuba River watershed. Two summers ago we were hiking on the second divide trail north of Downieville in the vicinity of Lavezzola Creek. Because of the behavior mountain bikers on that trail and the damage their bikes have done to the trail and the vegetation beside the trail, I will never hike that trail again. It was a terrible experience in which mountain bikers came barreling down a narrow mountainside trail giving us no heed whatsoever. We barely had time to get out of their way and were forced to cling to trees to keep from falling down the mountain. The destruction of vegetation along the sides of the trail was devastating to see, particularly as I had seen the beauty of the trail before mountain bike enthusiasts began using it." James Waggener

"Even though my horse is OK with bikes, I really appreciate knowing we are not going to be surprised on these trails by bikes. I have noticed deep rutting on the single track trails at Folsom done by illegal riding on the trails for hiking and equestrian use." Lynn Lundberg

"Once we found the equestrian trails at Lake Oroville, we were ecstatic. We finally had a quiet and cherished place to ride, which was only twenty minutes from home. The trails there offer the beauty of the countryside along with the lake itself, they are well maintained, and other than coming across other equestrians – it is quiet, we feel relatively safe, and they give us and our mounts a wonderful variety in obstacles and/or terrain. Knowing we did not have to contend with bikes, bicycles, hikers, and especially quad-runners, made it even more wonderful.

"So few places in the north state have decent parks and/or recreation areas, which sanction trail horses and their riders. In my opinion, it is imperative all existing trail systems at Lake Oroville remain as such. I reiterate: for trail horses and their riders only." Jill M. Slawson

"Since moving into our new home, we have heard the disturbing news that there are plans to allow mountain bikers on the same trail now designated for horses and hikers. This is an extremely dangerous idea. If this were to come about I believe that like myself, most equestrians and hikers would not feel comfortable using the trails, knowing that a speeding bicycle could tear around a bend, spook a group of horses and quite possibly cause someone injury. Mountain biking is a thrill sport pursued at high speeds. Most trail riders and hikers are out enjoying the serenity of nature." Helen Anderson

"My husband and I have been riding for over 50 years. Our horses are well trained and will tolerate bikes. However, the parks are allowing multi use trails where there is danger involved….We no longer ride at Whiskeytown Lake or Shasta Lake because the narrow, winding trails are too dangerous for multiple use. … Our horses will tolerate bikes if they can seem them or if they do not creep up behind us but so many of the state parks do not have safe trails for multiple use. I am afraid that pretty soon we won't have any place to ride." Joyce Pickering

"I operate a Training Stable south of Oroville, where I give riding lessons to all age groups and all levels of experience. I use the Oroville hiking/equestrian trails to give additional experience to these riders and horses. I refuse to use these trails if they are converted to multi-use. I refuse to risk the safety of my young and inexperienced riders and horses. I came very close to having serious injuries occur because of bicycles on the trail and I will not allow it again." Jim Halsey

Confirming the reduction of trail use by equestrians and hikers when mountain bikers are allowed on the same trails is the DPR's own Santa Cruz District Trails Supervisor's letter stating:

> "**I can't help but think that the increased bicycle usage may correlate to a decrease in other trail usage as more of our alignments become multi-use.**" (K. Lingenfelter Letter dated 3/10/02 attached to DWR's Recreation Plan License Amendment application, Appendix G.)[41]

DWR's limited trail user survey was conducted after the unauthorized conversion of the traditional trails to multi-use so they lost the input of those hikers and equestrians who stopped using the trails as a result of adding bikers.

2. Conversion of the traditional hiking-equestrian trails creates an unsafe and unpleasant trails experience for current users and causes non-bikers to leave the trails due to concerns for their safety.

Intervenors herein assert that the conversion of the equestrian and hiking trails to what is labeled "multi-use" would in fact create a trail system that for all intents and purposes is limited to bikers. That is primarily because of the speed, the discourteous behavior, and thrill seeking uses to which bikers would put these trails. Federal regulations require that "the siting, construction and maintenance of facilities shall be undertaken in a way that avoids or minimizes effects on scenic, **historic,** wildlife and **recreation values.**"[42]

[41] June 5, 2003 Motion to Intervene, Exhibit D, pg. 18.
[42] 18 CFR 380.15 (a).

In its own planning documents, DWR labels mountain biking as an "adventure/high risk" activity.[43] Even if the majority of bikers do not engage in unsafe trail usages and practices, it only takes a few unregulated and uncontrolled thrill seekers to render an entire trail and park area unsafe for hikers, horses and equestrians.

As DWR itself notes, first in its 1995 Supplemental Recreation Plan: **"Mountain bicycles have an impact on these user groups [hikers and horse riders] and can cause overcrowding as well as conflicts of the users."[44]** And again the California Recreational Trail Plan (Phase I) states:

> "In some instances, **the retention of current single-track trails can best meet the needs of trail users**, or they may be the only way of allowing public access while ensuring adequate protection of natural or cultural resources. … **While there has been some integrating or combining of different recreational user needs on individual trails, the efforts have not been universally successful**. In many areas relatively parallel trails designed for different users, such as paved bike trail and an equestrian trail nearby, have been constructive. While **this approach effectively separates two or more relatively incompatible trail uses**, it also is more expensive." [page 25, emphasis added][45]

There are documented cases of severe injuries to horses and riders. Indeed, while the LOSRA trails were illegally converted to multi-use, before FERC intervened in the matter and required the return of the trails to their original status under the old license provisions, a woman was thrown from her horse and suffered a broken back when a mountain biker, going too fast, startled her horse. As is too often the case when these incidents occur, the biker just kept on going. Intervenors also call to FERC's attention that the equestrian tried to file an incident report and was told since she was walking and talking, there was no need for an ambulance, and she could not identify the biker, "it would be a waste of their time to file a report." No wonder DPR

[43] Proposed Recreation Use – Final – R-12, Department of Water Resources, May 2004, pg. 5-18, Exhibit Z.
[44] Feather River Project Recreation Plan Supplemental Information (1995) DWR, Oroville Field Division, Exhibit AA, p.6.
[45] The California Recreational Trails Plan, Phase I, may be found at the California Department of Parks and Recreation website: http://www.parks.ca.gov/pages/1324/files/trails%20plan%20art%20final%203.pmd.pdf

and DWR claim there are no biker/rider incidents! See Exhibit AB, Declaration of Jacky Becker.

As another example of the hazards of bikers and riders sharing a trail, in October 2005 in Santa Barbara a horse was driven off a steep embankment by a bicyclist who did not stop. The horse eventually died from its injuries; fortunately, in this instance, the rider was not physically injured. The four-year user of the trails in the Santa Barbara area recounts the incident online:

> "About a year ago we had a run-in with mountain bikers. Luckily, the bikers had bells on their bikes so we heard them before we actually met with them. Our horses simply turned around when the bikers came around the corner.
>
> "This past Sunday [October 30, 2005] was a different story. I was on the Cold Spring trail, about a mile from the trail head when a mountain bike, no bell, no warning came around a blind corner. The horse spun and fell down a 200 foot drop into Cold Spring Creek. Luckily I was able to get off him about 10 feet down. However, after suffering for 3 hours, with a broken back from the fall, Rocket died at 6:30 pm."[46]

This account is the first in a series of comments that form a long email thread. Although some of the bikers responding in the thread are sympathetic, the following is a more typical comment:

> "Sorry about your loss. I can't help but feel that in your understandable desire to blame others for your loss, you're doing the community a disservice. The problem here seems to be that you're using a multi-use trail with what apparently was an animal unsuited to those challenges. Horses by their sheer size are a threat to everyone around them. A horse that is easily spooked even more so.
>
> "While it's easy to blame the cyclist for not showing you expected trail courtesy, the fact is that it was your uncontrollable horse that placed both you and itself in danger. It is terrible that such a thing happened, **but with your experience, you must have known the risks before you set out.**" [Emphasis added]

There are numerous other examples of riders or their horses being injured due to speeding bikers. Because equestrians and hikers have learned "the risks" that bikers add to multi-use

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[46] "Cold Spring Danger" viewed March 21, 2006, Exhibit AC, http://www.santabarbarahikes.com/community/phpbb/viewtopic.php?t=236&start=0&sid=3976c35b0310134e575130b30273f663

trails, equestrians and hikers often stop using them. What DWR has proposed as shared use trails become, due to risks to hikers and equestrians, dedicated bike tracks. The dangers associated with "shared" use are simply too great.

The letters from interveners and others show that there are many incidents where hikers and people on horses are harmed by or put at risk of serious harm by mountain bikers. These letters and comments are submitted to augment the record in this case. DWR, DPR, and other government staff people have claimed that there is no evidence of incidents or conflicts on the Lake Oroville trails. This is simply not true. If anyone surveys the equestrian and hiker user groups, including those who stopped using the Lake Oroville project area trails system while it was illegally converted, they will find that there are many complaints about actual accidents, injuries, near misses, and fear on the part of hiker and equestrian users.

The mischaracterization that there is no evidence of negative contacts between equestrians and bikers is entirely consistent with a pattern of lobbying by biker groups whereby bikers claim there are few or no negative contacts between user groups. After extensive study the Citizens Advisory Body Convened by the City of Los Angeles Department of Parks and Recreation produced a Majority Report in September 2000 to assist in Griffith Park planning. Their report, which is extensive, was provided as an exhibit to our June 5, 2003 Motion to Intervene. We cited some of their findings in the body of that motion:[47]

> "We discovered that the picture of successful trail sharing that had been presented to the Department by mountain biking advocates during the six-year advocacy process that preceded open discussion was not supported by the record. On the contrary, throughout the United States, a pattern of conflict and abuses on shared-use trails has emerged wherever there is population density. These include displacement, conflict, injuries, deaths, liability, and environmental degradation.
>
> "In the U.S. and Canada, recreation districts formerly supportive of mountain

[47] Motion to Intervene, Comments and Protest, Re: Project 2100-119, dated June 5, 2003, pgs. 16-17, Exhibit D.

> biking have closed trails and are in the process of closing trails previously opened to mechanized use. After years of investing recreational dollars, staff time and law enforcement resources into the shared-use effort, they have found that shared use involving mountain biking is unsustainable. This trend is accelerating.
>
> "This information, however, was not available to the Working Group at the start of the process. The bulk of the discussion has taken place without the knowledge of or input from the vast majority of park users and stakeholders. Led by individuals who derive monetary gain from mountain biking, a handful of advocates had set the agenda, shaped official perception, obscured threshold questions, dismissed documented conflicts and failures, belittled or stigmatized opposing viewpoints, and otherwise worked to erect a bulwark of myopia surrounding this issue." Majority Report Overview and Recommendations, p. 1.
>
> "***Once mountain biking is added to the trails, it defines the experience for everyone else.*** **Trails that are redesignated as shared or "multi-use", i.e., open to mountain biking, inexorably become single use trails — trails used by mountain bikers only. Users accessing the trail on foot decline because hiking, walking, running, and horseback riding in a vehicle environment becomes hazardous and stressful. The mind must stay focused, senses alert, reflexes at the ready to avoid collision. Those who come to the parks for relaxation ultimately withdraw."** [Citing the "Documented Evidence of User Conflict" portion of the Majority Report.] Majority Report, "Equity, Sharing and Civil Rights" pp.3-4; emphasis added.

Not surprisingly, bikers are not allowed to share the trails in Griffith Park, Los Angeles. They use to some 50 miles of paved roads; the park also has 55 miles of dirt trails for hikers and equestrians. There is only one park in the City of Los Angeles where bikers share trails with hikers and equestrians; they are otherwise restricted to paved trails.[48]

Intervenors have shared their concerns for hiker and equestrian safety with both DPR and DWR. They have been told that there are no records of any incidents on the trails. Based upon Jacky Becker's experience in attempting to make an incident report to park authorities[49], DWR and DPR are only interested in catastrophic incidents and do not care about the overall safety of the trail users nor the quality of their trails experience. No wonder there are no incident reports.

[48] Los Angeles City Ordinance 63.44 Paragraph B16.
[49] Declaration of Jacky Becker, Exhibit AB.

That attitude is yet another reason to protect hikers and equestrians by preserving some hiking-equestrian trails where their safety is not threatened by bikers.

3. The historic hiking-equestrian trails, the Dan Beebe, Roy Rogers, and Loafer Creek Loop Trails, are not safe or appropriate for conversion to multiple-use.

Given DWR and DPR's lack of study and detailed assessment of the hiking-equestrian trails, volunteers recently walked approximately 10 miles of the Dan Beebe Trail as well as 3 miles of the Roy Rogers and Loafer Creek Trails to gain some basic documentation on the trails and their configuration. They did not hike the Sycamore Hill section. The volunteers provided the following information, under the headings "Background, Reasons Against Converting the Traditional Hiking-Equestrian Trails to Multi-use, and Recommended Actions":

Background:

1. The Dan Beebe Trail was designed, constructed, and used as a riding and hiking trail since its inception in 1963 until 2002 when it was illegally converted to multi-use. The Roy Rogers and Loafer Creek Trails were dedicated in the late 1980s and also were illegally converted to multi-use from 2002 to 2004.
2. The trails were successfully used by hikers and equestrians prior to their conversion and were valued for their splendor as intimate and beautiful single-track trails that offered solitude and safety.
3. In 2000, perhaps earlier, State Parks began to widen portions of the trails from a single track to a 4-foot width and converted them in 2002 to "multi-use", to allow mountain bicycles to share the trails with hikers and equestrians.
4. Modifications to the trails and their change in designation were opposed by hikers and equestrians who successfully intervened and FERC ordered the trails returned to their original hiking-equestrian status in 2004.
5. Widening of the trails with mechanical equipment destroyed the established single track tread, removed functioning water bars and drainage patterns, and created erosion and an unconsolidated trail surface that degraded both the physical and aesthetic qualities of the trail. These environmental impacts of these actions have never been evaluated.
6. The introduction of bicycles to the trails created new safety risks to trail users: fast-moving bikers created new hazards; even slower bikers can be hazardous given the multitude of blind corners along the trail. Unlike hikers and riders who can stop within a stride or two, bikers require some distance to stop and may skid in the process.
7. The 4-foot width is insufficient to allow safe passage of riders or hikers and bikers using the trail, and steep cross slopes often prevent users from stepping easily off the trails to allow safe passage.
8. Trail grades that frequently exceed 10% for extended distances encourage unsafe speeds by bicycles traveling down hill.

9. Some grades exceed 20% along the trail and 15-20% grades are common.
10. The trails as they exist today do not comply with State Parks standards for multi-use trails.[50] Scraping and grading them in an attempt to make the trails meet those standards would destroy the quality of the current users' experience and cause significant environmental damage.
11. For these reasons, the traditional hiking-equestrian trails are unsafe and inappropriate for conversion to a multi-use trail.

<u>Reasons Against Converting the Traditional Hiking-Equestrian Trails to Multi-use:</u>

1. The Dan Beebe, Roy Rogers, and Loafer Creek Trails were designed, built, and maintained as single-track equestrian and hiking trails.
2. The historic use of the Dan Beebe Trail was successful and unchanged between construction of the trail in 1963 and its unilateral conversion by State Parks in 2002. It and the other hiking-equestrian trails were returned to hiking-equestrian use by FERC order in 2004.
3. Widening portions of the trails from single track to their current 4-foot width both destroyed the stability and integrity of the trail surfaces and changed the intimate and desirable character of the single track by removing desirable vegetation and native rock outcroppings.
4. During the unauthorized conversion when mountain bikers used the trails, many hikers and equestrians felt unsafe and were deterred from using these historical riding and hiking paths.
5. There have been incidents between cyclists and equestrians. One example is documented in the declaration of Jacky Becker, attached as Exhibit AB. Ms. Becker rode the Loafer Creek Trail in September 2003 during the period of its unauthorized conversion.
6. The fundamental qualities of the equestrian and hiking experience that make these trails desirable have been seriously degraded. The proposed conversion would make what has been a peaceful and serene trail experience a hazardous one of anxiety and apprehension.
7. Any attempt to reduce safety hazards through further "improvements" to the trails would only serve to further degrade the intimate and natural character of the former single track trails as they, inevitably, would be engineered to an ever-wider and more open roadway that would be necessary to allow safe passage between fast-moving bicycles and equestrians and hikers.
8. Therefore, only the preservation of the traditional hiking-equestrian trails in their historic use exclusively by equestrians and hikers will satisfactorily resolve these conflicts.

<u>Recommended Actions:</u>

1. Preserve the hiking-equestrian designations on the Dan Beebe, Roy Rogers and Loafer Creek Trails.
2. Allow the trails naturally to return to a single track.

[50] Trails Handbook, The Resources Agency, Department of Parks and Recreation, 1991, pgs. 16-1 and 16-2, Exhibit AD. Intervenors herein and in their previous intervention allege and show it is impossible at the location of the traditional hiking-equestrian trails to meet recognized "safe engineering practices" as required by 18 CFR 380.15 (c): "Safety Regulations. The requirements of this paragraph do not affect the sponsor's obligation to comply with safety regulations of the U.S. Department of Transportation and recognized safe engineering practices."

3. Establish a new dedicated trail parallel to, but significantly removed from, the Dan Beebe Trail for mountain bicycles.

Exhibit P-1 includes photos which show the character of the Dan Beebe Trail, including examples of some areas where the grade regularly exceeds 10%, and some areas with significant drop off so that trail users cannot safely leave the trail to avoid speeding bikers. The result is a clear sense that this is a beautiful trail designed for hikers and equestrians; it serves those two user groups very well. Exhibit P-2 has photos from the Loafer Creek and Roy Rogers Trails, again showing the single-track nature of the trails. To add bikers to any of these historic hiking-equestrian trails, even just some sections, would degrade the experience for current users, adding hazards that likely would discourage their use of the trails.

It is possible to add dedicated bike trails to the Project area. The Brad Freeman trail was completed with funding from several agencies and entities. It provides 41 miles of trail, circling much of the Oroville Project. DWR described the need for the bike trail, because of crowding and user conflicts, in their 1995 Recreation Plan Supplemental Information:

> "As there is currently no designated route for mountain bicycles in the area, the mountain bicycle users must use roadways and trails intended for horses and people. **Mountain bicycles have an impact on these user groups and can cause overcrowding as well as conflicts of the users.** The [then proposed and now existing] mountain bicycle trail will minimize, and in some areas eliminate, these conflicts between users by having a designated bicycle route."[51]

DWR did not advocate conversion of trails to multi-use to provide access for bikers. Like the user groups that would make recommendations during the ALP process, they recommended that a dedicated bike trail be added to LOSRA.

There is no need to convert the traditional hiking-equestrian trails to provide bikers with trail access; they already have many miles of trails within LOSRA and the surrounding area. It is

[51] Exhibit AD, pg. 6.

possible to increase biker access, **without** converting the traditional hiking-equestrian trails. Exhibit P-3 shows two of the areas along the lakeshore where bikers are allowed.

DWR has no documentation to demonstrate a need to convert the traditional hiking-equestrian trails in its R-13 "Recreation Surveys" document.[52] The December 2004 document describes the results of user surveys conducted beginning in May 2002. The surveys indicate that horse back riding and hiking are more of an attraction to the area than mountain biking. In Table 5.1-8, "Activities participated in during visit to Lake Oroville area," mountain biking represents a significantly smaller percentage of chosen activities than is either hiking or horseback riding. Table 5.1-9 again shows horseback riding as the primary activity of a higher percentage of Lake Oroville visitors than mountain biking, 58.6% vs. 8.6% in the Diversion Pool area, for example.

The survey also asked LOSRA users whether they thought that there were too few trail facilities. Some hikers, bikers, and equestrians indicated there were "too few" trails. Equestrians in the diversion pool area had the greatest number of positive responses to this question (43%). DWR indicates that most trail users did not feel crowded, eliminating yet another need to distribute users across a variety of trails. Suggesting support for Intervenors' motion to preserve the hiking-equestrian trails, the survey identifies problems with other users as one of the leading reasons for trail user dissatisfaction, following maintenance issues and on a par with wanting more trails and being disturbed by trail damage from trail grader use. The survey was conducted during the time that the traditional hiking-equestrian trails were illegally converted to multi-use.

This document, with its survey data, does not provide any demonstrated need to convert the traditional hiking-equestrian trails. There are no other studies available.

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[52] Recreation Surveys – Final – R-13, December 2004, California Department of Water Resources, pgs. 4-1, 5-10, 5-11, 5-27, 5-51 and 5-54, Exhibit AE.

4. Conversion of the traditional hiking-equestrian trails would have a significant environmental impact; this has not been studied. NEPA has not been satisfied.

As the volunteers noted in hiking portions of the traditional hiking-equestrian trails:

> "Widening of the trail with mechanical equipment destroyed the established single track tread, removed functioning water bars and drainage patterns, and created erosion and an unconsolidated trail surface that degraded both the physical and aesthetic qualities of the trail. These environmental impacts of these actions have never been evaluated."

Neither DWR nor DPR has undertaken a detailed assessment of the hiking-equestrian trails which they propose to convert.[53] Intervenors are very aware of the sort of trail degradation volunteers have documented on the historic hiking-equestrian trails due to bikers as well as the "maintenance" activities DPR performed during the trails' unauthorized conversion to multi-use.

One of the intervenors, an equestrian and a biker, notes:

> "I've seen the ruts caused by my own bike's tires. Water gets into these ruts and creates stream channels that erode the trail bed. Conversely, when riding horses, I've noticed that the horses hoof prints on a sloped trail create tiny dams that prevent the water from creating channels. Later, when the trails have dried, the horses' hooves tend to flatten out both their own tracks and those of the mountain bikes, as well as tamping fallen leaves into the trail bed, making it less susceptible to erosion. From what I've seen of various trails in five states, mountain bikes are an environmental disaster on dirt trails."[54]

In the RMP at issue, DWR promises an assessment of safety and appropriateness of conversion prior to converting the trails. Such studies are mandatory before conversion is even proposed; they have not been performed. Based upon the experience and observations of many of the Intervenors on the environmental impact on trails of what has already been done, once thorough environmental studies are undertaken, it will be obvious that there are in fact significant impacts to converting the traditional single-track hiking-equestrian trails to multi-use. The extent of those impacts, along with the increased danger to existing trail users, demands the preservation of the existing hiking-equestrian trails.

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[53] "It will be the general policy of the Federal Energy Regulatory Commission to adopt and to adhere to the objectives and aims of the National Environmental Policy Act of 1969 (NEPA)." 18 CFR 2.80 (a).
[54] Personal communication from Kathleen Lyons.

At other park sites in the United States, mountain bikes have caused permanent significant environmental damage. As one example, in its February 1994 issue, National Geographic magazine states: "On BLM Land near Arches National Park, the living desert crust takes a constant beating from mountain bikers, who have chosen this area in Utah as their own special paradise. Thus damaged it may never recover." Intervenors also refer FERC to a recent detailed review of mountain bike environmental damage submitted by Michael Vandeman, PhD, FERC No. 20060315-5080. And as yet another example, in a USDA Forest Service Research Paper (PSW-RP-226-Web. 1996[55]) a survey of National Park Service managers found:

- 58 percent of Forest managers reported seeing evidence of resource damage from mountain bike use.
- 70 percent of Forest managers reported they had observed or received reports of user conflicts.
- 59 percent of Forest managers observed or reported safety problems related to mountain bike use.

This is the kind of serious and irreparable environmental damage and user conflict which DPR and DWR have chosen to ignore. With blatant disregard for potential impacts on the environment and current trail users, DWR gives itself a finding of no significant impact in their Preliminary Draft Environmental Assessment of the Project.[56]

There are alternatives to converting these trails, including the important "no project" alternative that must be considered in an environmental assessment. The 1993 Recreation Management Plan commits to "continuing existing recreational facilities[57].

5. There are no plans or a budget to enforce safe trail use, such as speed and right of way regulations on any of the proposed multi-use trails.

In public workgroup committees and other public input opportunities, Intervenors have supported the establishment of several multi-use trails within LOSRA and the environs where

[55] http://www.fs.fed.us/psw/publications/documents/rp-226/
[56] PDEA (Exhibit B), pg. 10-1, 10-2.
[57] Exhibit N, pg. xi.

they believe the configuration of the trail may provide for a safe and appropriate conversion to multi-use. However, Intervenors are also very aware that the State of California is in a budgetary crisis. There are no detailed plans or proposals to assure the safety of users of these wider, more level and appropriate proposed multi-use trails. Even when the trails are safe and appropriate for conversion to multi-use, unlike the hiking-equestrian trails that are the subject of this intervention, there are staff and resource costs to make those conversions successful. As Superintendent Jacqueline Ball, Gold Fields District, notes in explaining the failure to establish some multi-use trails at the Folsom Lake State Recreation Area:

> "[T]o effectively and successfully convert this section of trail [Browns Ravine in the Folsom Lake State Recreation Area] to multi-use would take a good deal of additional staff time, including rangers. The research that FTAG [Folsom Lake Trail Advisory Group] and my staff conducted in evaluating this pilot indicates that agency presence is a critical component for success. The conversion plan called for extensive public education, patrol presence (volunteers and DPR staff) and monitoring – all of which would require additional staff time."[58]

As was the case in 2002 when Ms. Ball wrote to concerned Folsom Lake SRA park visitors and neighbors, and as is the case today, there are not sufficient funds in the State of California to assure adequate monitoring of multi-use trails. This is true in LOSRA for those trails that ARE safe and appropriate to convert to multi-use; attempting to patrol unsafe and inappropriately converted multi-use trails such as the traditional hiking-equestrian trails would be a budgetary and staffing nightmare.[59]

Based on DPR and DWR actions to date, Intervenors are concerned that even the more appropriate multi-use conversions proposed in the RMP will not be accompanied by patrolling

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[58] Letter dated April 19, 2002, from Jacqueline Ball, Superintendent, Gold Field District, to Concerned Park Visitor or Neighbor, pg. 1.

[59] "Reasonable expenditures by a licnsee for public recreational development pursuant to an approved plan, including the purchase of land, will be included as part of the project cost." 18 CFR Section 2.7. There is no evaluation of increased user costs or conversion costs , initial, maintenance, or enforcement costs in any planning documents.

and enforcement provisions to assure the safety of all trail users. Given that fact, Intervenors seek to protect their safety and peaceful enjoyment of at least some trails within LOSRA. The traditional hiking-equestrian trails must remain hiking-equestrian trails in order for the Intervenors as well as other hikers and equestrians to continue to safely enjoy those trails.

V. RELIEF SOUGHT

By filing this intervention these Intervenors are seeking a review and determination of matters related to the recreational planning component of the new license and, more specifically, the review or lack thereof of the traditional equestrian and hiking trails and the proposed conversion of those trails to include mountain bicycles. This intervention is not, therefore, intended to address or interfere with FERC's review of other broader or “larger” issues, such as the operation of the dam itself, hydroelectric power generation and distribution, or water project issues related to down stream users. Intervenors' issues can be addressed in the more limited context of seeking a resolution by FERC of specific inadequacies in the licensee's review of the trails component in the licensee's documentation and proposed recreation plan requirements to be included in the final overall license.

Specifically, the below named organizations and individuals request that (i) these COMMENTS and PROTEST be considered by FERC in its deliberations; (ii) that their MOTION TO INTERVENE be accepted and granted; and (iii) that FERC take the following remedial actions in this matter pursuant to the Federal Power Act and the implementing Code of Federal Regulations at 18 C.F.R. 1 *et seq*. and other federal laws cited herein, as follows:

1. Order DWR to preserve and protect the traditional hiking-equestrian trails as a unique resource for the hikers and equestrians that have enjoyed those trails, some for more than forty years, as well as for future generations of hikers and equestrians. Prevent DWR and DPR from

"maintaining" or modifying these trails by widening them beyond their current single-track configuration. Such "maintenance" would result in the tragic loss of a unique and valued trails experience as well as exacerbate environmental damage from previous "maintenance" activities.

2. Require that DWR and DPR maintain and dedicate these trails as single-track hiking-equestrian trails in the new license period, providing funds sufficient for supervision, signage, and barriers so that the hikers and equestrians who use the trails will be safe from the dangers of bikers riding trails that inappropriate and unsafe for multi-use.

3. Order that DWR and DPR provide copies on request of their financial statements, accountings, budgets, and related information which describes the state agencies' receipts and expenditures, including funds from contractors, income, and grants, expenses, management costs, and fiscal planning and recreation management process costs for the FERC Project 2100 license area.

4. Revise the draft settlement agreement by the following:

a. Remove the provision in the RMP stating that only parties who signed the proposed settlement agreement may be members of the proposed Recreation Advisory Committee;

b. Remove the provision that a signatory may not consider material new evidence, particularly that provided in the process of NEPA, CEQA or other environmental reviews of any Project proposal;

c. Remove provisions that a signatory may not withdraw from the settlement agreement; and

d. Remove the provisions of the settlement agreement that prevent a signatory from criticizing the settlement agreement or the management plans to FERC or any other agency.

CONTACT PERSON FOR INTERVENERS, COMMENTORS, AND PROTESTORS

Please direct questions or provide further information or correspondence to William O. Davis, Attorney at Law; Attention: Tara Steele, Administrative Assistant; 530-335-7166; FAX 530-335-7224; email bdavis@shastalaw.net or tsteele@tsteele.net; PO Box 64, Old Station, CA 96071.

As legal counsel and custodian of records for the below identified moving parties and commentors, I declare subject to the penalty of perjury under the laws of the State of California that the Exhibits attached to and referenced in this document are true and correct copies of the documents they purport to be, and that Service of this Intervention, Comments and Protest was made all parties on the Service List for this Project as shown below.

DATED: March 31, 2006

William O. Davis

William O. Davis, attorney for
Individuals and Organizations as follows:

Intervenors

Note: Individuals or organizations which have not had time to review the Settlement Agreement, Recreation Management Plan, and related Environmental Assessments, may join the present Intervenors in the future. Therefore, there may be separate motions to late join this list.

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Meadow Vista, California

Backcountry Horsemen of California
Caballeros del Sol Unit
Attn: Kathleen Hayden
Santa Ysabel, CA

Backcountry Horsemen of California
Coyote Canyon Caballos d'Anza Unit
[501 c 3 status pending]
Attn: Robert Hayden
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Backcountry Horsemen of California
North Bay Unit
Attn: Virginia Lewis
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Backcountry Horsemen of California
Sutter Buttes Unit
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California Equestrian Trails & Lands Coalition ("C.E.T. & L.C.")
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Chico Equestrian Association
Atttn: Linda Crum
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Equestrian Trail Riders
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Equestrian Trails, Inc.
Attn: Lynn Brown, National Trails Coordinator
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MOTION TO INTERVENE, COMMENTS AND PROTEST, Dated March 31, 2006, From William O. Davis, an individual, as Agent on behalf of various organizations and individuals

RE: Project P-2100, and P-2100-052, Oroville Facilities – California Department of Water Resources, Draft Settlement Agreement filed March 24, 2006, and the Draft Settlement Agreement Recreation Management Plan Dated December 2005

Exhibits[60]

Exhibit A1: Letter from Lon Crow, FERC to Tres Hobbie, Chair, ORAC, dated August 17, 2000.

Exhibit A: Draft Settlement Agreement Recreation Management Plan [sic], Department of Water Resources, December 2005, selected pages. FERC No. 20060324-5019.

Exhibit B: Preliminary Draft Environmental Assessment, Department of Water Resources, January 2005, selected pages, from DWR's License Application, FERC No. 20050126-4023.

Exhibit C: "Extra Horses Being Sought for Dedication Ride", Oroville Mercury Register, June 4, 1963. "Riding Trail Improvements," Oroville Mercury Register, April 11, 1978.

Exhibit D: Motion to Intervene, Comments and Protest of Action Coalition of Equestrians et al, dated June 5, 2003, Project No. 2100-129. FERC No. 20030606-5007.

Exhibit E: Order Denying Request to Amend Recreation Plan and Final Environmental Assessment, Issued August 17, 2004, Federal Energy Regulatory Commission, Project No. 2100-119. FERC No. 20040817-3010.

Exhibit F: Order Denying Rehearing, Issued January 21, 2005, Federal Energy Regulatory Commission, Project No. 2100-119. FERC No. 20050121-4009.

Exhibit G: Settlement Agreement for Licensing of the Oroville Facilities, State of California, Resources Agency, Department of Water Resources, FERC Project No. 2100, March 2006. Selected pages. FERC No. 20060324-5019.

Exhibit H: Declaration of Janine Cody, dated March 29, 2006.

Exhibit I: Declaration of Robert Weinzinger, dated March 27, 2006.

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[60] In the interest of brevity and a manageable document, Intervenors have only provided the referenced pages to the various agency documents cited as Exhibits in the matter. Their FERC eLibrary document numbers are noted as part of the citation.

Exhibit J: Recommendations to the Recreation and Socioeconomics Work Group, October 25, 2001.

Exhibit K: "Lake rec projects approved;" "Lake Oroville SRA expands trails use;" Oroville Mercury Register, February 8, 2002.

Exhibit L: "Final Trails Committee Report" dated September 21, 2001, from Pete Dangermond to Chairman and Board of Directors.

Exhibit M: Letter from Wade Hough, Chairman, ORAC, to Magalie Salas, Secretary, FERC, dated March 17, 2003. Department of Water Resources, June 1993.

Exhibit N: Proposed Amended Recreation Plan for Lake Oroville State Recreation Area, California Department of Water Resources, June 1993, selected pages. FERC No. 19930604-0332.

Exhibit O: Email from Mark Andersen to Cathy Hodges, dated September 23, 2004.

Exhibit P: Declaration of Annette D. Kolkey, dated March 28, 2006.

Exhibit Q: Email dated December 22, 2005, from Anna West, Kearns & West [settlement group facilitators] to Cathy Hodges.

Exhibit R: Letter from Kevin Zeitler, Chair, ORAC to Magalie Salas, Secretary, FERC, dated January 27, 2006.

Exhibit S: Letter dated March 21, 2006, from Sam Aanested, Senator, 4th District, to Director Lester Snow, Department of Water Resources.

Exhibit T: Oroville Facilities Relicensing News, December 2002, "FERC Official Discusses the Alternative Licensing Process," pg. 2, 6.

Exhibit U: Recreation Activity, Spending, and Associated Impacts Final R-18, Department of Water Resources, May 2004 , pg. 4-2

Exhibit V: "Most Comprehensive Horse Study Ever Reveals a Nearly $40 Billion Impact on the US Economy, June 28, 2005" United States Equestrian Federation, Inc., website, printed 3/28/2006 www.usef.org

Exhibit W: Email dated March 8, 2006, from Rick Ramirez to Janine Cody, Oroville Pageant Riders.

Exhibit X: Letter dated August 3, 2005, from Bob Svedeen, C.S.H.A. State Trails Chairman, to Kevin Zeitler, Chair, ORAC.

Exhibit Y: Letters, emails and survey responses provided by hikers and equestrians:

- Email sent September 14, 2004, 7:08 p.m., from Peggy Eldridge.
- Letter dated November 28, 2004, from Karan Jo White
- Letter dated November 30, 2004, James Waggener
- Email dated December 11, 2004 from Lynn Brown.
- Letter to the Editor, Oroville Mercury Register, January 22, 2005.
- Email dated July 31, 2005 from Joyce Pickering.
- Letter dated August 3, 2005 from Uel B. Marr.
- Tapia Spur Trail Accident, August 9, 2005, from Saul Berman.
- Survey form returned to A.C.E. August 24, 2005, from Lynn Lundberg.
- Letter dated October 4, 2005, from Jill M. Slawson.
- Letter dated March 23, 2006 from Helen Anderson.
- Survey and accompanying comment dated March 25, 2005 from Randy Brace.
- Faxed letter and survey form returned to A.C.E. dated March 27, 2006, from Michael Murphy.
- Letter dated March 28, from Jim Halsey, Halsey Creations.
- Letter dated March 29, 2006, from Peggy (Margaret A.) Berry.
- Letter dated March 29, 2006, from Stephanie Sager.

Exhibit Z: Proposed Recreation Use – Final – R-12, Department of Water Resources, May 2004, selected pages.

Exhibit AA: Feather River Project Recreation Plan Supplemental Information (1995) DWR, Oroville Field Division. FERC No. 19950914-0023.

Exhibit AB: Declaration of Jacky Becker, dated March 29, 2006.

Exhibit AC: http://www.santabarbarahikes.com/community/phpbb/viewtopic.php?t=236&start=0&sid=3976c35b0310134e575130b30273f663 viewed March 21, 2006.

Exhibit AD: Trails Handbook, The Resources Agency, Department of Parks and Recreation, 1991.

Exhibit AE: Recreation Surveys – Final – R-13, December 2004, California Department of Water Resources.

Exhibit AF: Letter dated April 19, 2002, from Jacqueline Ball, Superintendent, Gold Field District, to Concerned Park Visitor or Neighbor.

Photographic Exhibits

P-1: Photographs of the Dan Beebe Trail, taken March 2006.

P-2: Photographs of the Roy Rogers and Loafer Creek Loop Trails, taken ____.

P-3: Photographs of bike trails in LOSRA, taken March 2006.

From: CEQA NSC
Sent: Tuesday, November 30, 2010 11:05 AM
To: West, Heidi
Subject: JBartlett_MHC_11-29-10

Attachments: Change of Use Survey 11-30-2010.doc

From: Joel Bartlett [joelpbartlett@yahoo.com]
Sent: Monday, November 29, 2010 2:00 PM
To: CEQA NSC
Subject: Change In Use

Please find attached a letter RE: Road and Trail Change-In-Use Evaluation Process from the Marin Horse Council.

Best regards,
Joel Bartlett
President
Marin Horse Council

Marin Horse Council
171 Bel Marin Keys Blvd.
Novato, California 94949

November 29, 2010

Heidi West, Environmental Coordinator
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814

Via Fax: (916) 445-8883
Email: ceqansc@parks.ca.gov

RE: ROAD AND TRAIL CHANGE-IN-USE EVALUATION PROCESS
Program Environmental Impact Report
State Clearinghouse Number 2010092023
ELIMINATION OF COMPLETE CEQA PROCESS

Dear Ms. West:

The Marin Horse Council is writing to you with grave concerns about the subject process that the State Parks are proposing to initiate that will in anyway **"benefit from streamling of the CEQA process"**. In addition to the preservation of the environment in our precious State Parks we are also concerned about the displacement of historical users who travel by foot due to eminent safety concerns that change in use will present if non-motorized vehicles are allowed on foot paths.

It is unimaginable that this proposed "project" could cover all the environment and safety issues on every trail change that the State Parks would consider doing. Due to extreme pressure from non-motorized users to open foot paths to their use, it is understandable that the State Parks would consider streamlining the process of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines. However, we must not allow the greasing of the wheels of change to compromise the environment and the safety of the larger group of traditional users. A check list will not replace the well-thought requirements of CEQA. The CEQA guidelines exist to protect the environment of the State Parks. The majority of Americans and traditional users of the State Parks demand the State Parks land managers protect the environment of our Parks not compromise it at the request of a user group.

Recently, the State Parks tried to make inappropriate user changes to Bill's Trail in Marin County. Biking organizations were so sure these changes would happen they even made public announcements it was open to non-motorized vehicles. Fortunately, the Marin Conservation League brought suit to protect the environment and uphold the CEQA requirements. This was a loud statement from a large member-based, environmental group. Why has the State Parks refused to hear this call to protect the environment and instead seems to be making an end-run at the CEQA process?

In Marin County one of our County Parks, China Camp, was made to open its foot paths to non-motorized vehicles. The results are visible to any visitor of the Park and we recommend State Park officials visit this Park. There is degradation of the trails and environment from bike use. There is displacement of traditional users due to safety concerns, i.e. hikers and the elderly who live close by in retirement residences, and equestrians. Now this beautiful park is primarily used only by bikers. Traditional users of the State Parks should not be put at physical harm when visiting the State Parks.

We are asking the land managers of the State Parks to respect the natural environment of our State Parks by honoring the CEQA process and to protect the safety of the traditional visitors, who are the largest users of our California State Parks.

Yours truly,

Joel Bartlett
President
Marin Horse Council

JB/ab

From: CEQA NSC
Sent: Tuesday, November 30, 2010 10:31 AM
To: West, Heidi
Subject: DFeldmann_SB Audubon_11-30-10

Attachments: SBVAS re State Parks Change in Use.doc

From: Drew Feldmann [drewf3@verizon.net]
Sent: Tuesday, November 30, 2010 10:28 AM
To: CEQA NSC
Cc: kstitt@earthlink.net
Subject: Change in Use

Please see the attached comments.

Thank you.

Drew Feldmann
Conservation Chair
San Bernardino Valley Audubon Society
909-881-6081

November 29, 2010

Heidi West, Environmental Coordinator
California State parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, CA 95814

By email to ceqansc@parks.ca.gov

SUBJECT: Comments on Revised Notice of Preparation of Road and Trail Change in Use Program Environmental Impact Report (PEIR); State Clearing House Number 2010092023

The San Bernardino Valley Audubon Society is the local chapter of the National Audubon Society for almost all of Riverside and San Bernardino Counties, and has about sixteen hundred members in that area. Our missions are the protection of natural habitat for birds and other wildlife, and public education about the environment. We are a 501c(3) organization. Our members are active users of state parks and recreation areas (herein after “park” or “parks”), as many of these areas are good places to observe California’s diverse population of birds.

SBVAS has reviewed the revised NOP for this project, and an SBVAS board member attended the public scoping meeting held at Lake Perris on November 13, 2010.

This program will have numerous variables depending on the specifics of current road or trail use and the proposed future road or trail use that will vary not just from park to park but likely within individual parks. Indeed, the NOP lists some twenty or so different possibilities changes for a single road or trail. Multiplying that by all the roads and trails in all the parks results in an enormous number, so understandably, State Parks has chosen to develop a PEIR to address the issue, which will have to be generic in nature.

For the same reasons, this letter of comment, in advance of the PEIR, will be generic in nature and will address our most basic concerns. These concerns are primarily the likelihood of loss of habitat with its negative impact on wildlife populations, and to what extent will the proposed changes increase greenhouse gases or otherwise promote climate change.

Questions that must be asked of each proposed change (or lack of change in the face of a perceived need), include:

- Balancing the perceived need for a change against the likely negative consequences. Is the change truly necessary? What factors truly justify a change from the status quo?
- What will be the impact on biological resources if the change is made or not made? With which alternative will biological resources be better off?

- If a change is made that will be deleterious to biological resources, what mitigation will be made that will truly balance or compensate for the deleterious effects? (In our experience, “mitigation” typically results in net loss of habitat.)
- What will be the cumulative impact of all the proposed changes on the environment? On wildlife? On greenhouse gas and climate change factors? Is there some threshold – even if only approximate – after which supposed beneficial effects become progressively less beneficial and more deleterious?
- Given the state’s budgetary problems, should State Parks even be addressing this issue at this time?

These are some of the basic questions that State Parks must thoroughly address in the upcoming PEIR.

Please keep us informed of all public notices, public hearings, published reports, and the like. Our mailing address is given on the letterhead. My phone number and email address are given below.

Thank you.

Sincerely,

Drew Feldmann
Conservation Chair
Drewf3@verizon.net
909-881-6081

Equestrian Trails, Inc. ®

13741 Foothill Boulevard, Suite 100
Sylmar, California 91342
(818) 362-6819   Fax (818) 362-9443
eti@etinational.com

ORGANIZED 1944

November 29, 2010

Environmental Coordinator-Trail PEIR
1 Capital Mall, Suite 410
Sacramento CA 95814

Re: Trails PEIR

Dear Environmental Coordinator,

As the National Trail Coordinator for Equestrian Trails Inc., I have been attending meetings on the Change of Use Program for several years.

As it is now written, the proposed document is deeply flawed in its language and possible execution. It would appear to be very biased as a tool for mountain bikers to crowbar themselves onto trails where their presence is inappropriate and threatens the safety of other users.

State Parks presently has credibility and trust issues involving both hikers and equestrians. With the Change in Use Program, these credibility and trust issue are considerably heightened in the minds of the traditional trail using public. Few people of the traditional group feel that they could use the Change in Use to effectively remove bikes from trails where there are safety and conflict issues.

We reserve the right to submit additional relevant information at a future date.

Sincerely,

LYNN BROWN

A NON-PROFIT ORGANIZATION Dedicated to Equine Legislation, Good Horsemanship, the Acquisition and Preservation of Trails

Please visit our website: etinational.com for Corral activities & information

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A NON-PROFIT ORGANIZATION Dedicated to Equine Legislation, Good Horsemanship, the Acquisition and Preservation of Trails

NOP Comment Letter O-8

ceqansc@parks.ca.gov

From: Waldron, Gary
Sent: Tuesday, November 30, 2010 10:26 AM
To: West, Heidi
Subject: TWard_IMBA_Comments 11-30-10

Attachments: Final PEIR-MSK-Ward.doc; ATT00001..htm

Heidi,

Below and attached is related to the Trails PEIR. Please file with the rest of the scoping comments.

Gary Waldron
Manager, Resource Services
Northern Service Center
(916) 445-8772

From: Tom Ward [mailto:tom@imba.com]
Sent: Tuesday, November 30, 2010 10:10 AM
To: Waldron, Gary
Subject: Attachment: PEIR Scoping Comments, Road and Trail Change-in-Use

Gary,
Attached please find our comments on the scoping for the Road and Trail Change-in-Use, Program Environmental Impact Report (PEIR). The mountain bike community in California is strongly committed to establishing an objective, science based process for trail access decisions. Too often in the past, trail access decisions have been fraught with bias, whims of users and political overlays that have successfully excluded mountain bikes from some park trails. It is our belief and hope that a carefully constructed PEIR will go a long way in making more efficient and effective trail access decision.

We look forward to working with State Parks on the PEIR, and we are available to provide any additional information as the process moves forward.

We appreciate the opportunity to provide input to this very important process.

Tom

INTERNATIONAL MOUNTAIN BICYCLING ASSOCIATION PO BOX 7578 BOULDER CO 80306 USA 303.545.9011 www.imba.com

Tom Ward
IMBA California Policy Director
2750 Land Park Drive
Sacramento, CA 95818
916-505-6875
tom@imba.com

Gary Waldron
Environmental Manager
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, California 95814
gwald@parks.ca.gov

November 29, 2010

Re: Notice of Preparation (NOP)
2010 Road and Trail Change-in-use Program Environmental Impact Report (PEIR)

Dear Sir:

I am writing on behalf of the International Mountain Bicycling Association (IMBA) and the interests of the millions of mountain bikers that ride natural surface trails throughout California and the California State Park System. The purpose of this letter is to provide input on the Notice of Preparation of the "Road and Trail Change-in-use Evaluation Process, Program Environmental Impact Report, State Clearinghouse # 2010092023" (PEIR).

IMBA is a non-profit educational association, whose mission is to create, enhance and preserve great trail experiences for mountain bikers worldwide. Since 1988, IMBA has been bringing out the best in mountain biking by encouraging low-impact riding, volunteer trail work, participation and cooperation among different trail user groups, grassroots advocacy and innovative trail management solutions. IMBA's worldwide network includes 32,000 individual members, more than 450 bicycle clubs, more than 175 corporate partners and about 200 bicycle retailers. IMBA's members live in all 50 U.S. states, most Canadian provinces and about 30 other countries.

We appreciate the opportunity to comment on the scoping process for the PEIR concerning trail conversions. We have worked with state parks for many months and years in an effort to have more mountain bike access to units in the State Park System. We appreciate the opportunity to comment on a process that we hope will eventually lead to more equitable distribution of trail opportunities for all trail users. Our specific input as to what needs to be included in the future PEIR document is as follows:

General Comments

1. The PEIR should be composed in such a manner as to present exhaustive listings of mitigation measures for as many potential environmental impacts associated with trail conversion projects as feasible. These mitigation measures will then form the "palette" or "toolbox" of implementation actions from which State Parks staff can choose to reduce "potentially significant" impacts to "less than significant with mitigation." The PEIR should make it clear that if project implementation includes the use of any or all applicable mitigations from the PEIR "palette", then no further consideration under CEQA is warranted *unless* there are impacts that are not addressed by mitigation measures contained in the "palette". It must be made clear by State Parks that any and all planning documents make clear which mitigation measures are applicable to

each project. We believe that the use of such a process will “pre-approve” most trail use conversions under consideration by State Parks now and in the future.

2. It must be stated in the PEIR that mountain biking, equestrian use, hiking, walking and running are all legitimate forms of trail recreation and hence have legitimate claim to trails and trail systems in the State Park System. Legitimacy for access should not be based on historical use patterns, who was there first, or who is the most recent arrival. In many cases, cyclists are unjustly vilified and perceived to not belong on natural surface trails. This in turn has influenced public policies and practices that unfairly exclude cyclists from many trail systems.

3. As a guiding principle, the number of trail miles in a given park unit should be proportionately allocated to users based upon the size of the user group. There are millions of mountain bikers in the state, and in many instances they are second to hikers in terms of user numbers, with equestrians being a distant third. Yet cyclists often get the smallest allocation of trail miles, and in some cases no trail miles at all. When a request is made for a change in trail use in a specific park unit, state parks must determine the number of trail miles within the unit and allocate trail miles according to the size of the user group. Calculation of trail miles for cyclists must consider the latent size/demand of the bike community because there are many park units that have unfairly excluding mountain bikers for years.

4. The definition of “trails” must be clearly stated in the PEIR. Mountain bikers, like many other trail users, prefer narrow, singletrack trails as opposed to service and fire roads. Unfortunately, State Parks often counts these roads as “trails” available to cyclists. We strongly urge that the PEIR make it clear that multi-use on singletrack trails is a usage goal for state park units.

5. The subject of “trail conflict”, although not a legitimate topic for a PEIR, nonetheless cannot be ignored and should be addressed in the preamble of the PEIR document. The concept of conflict is highly subjective and is often based on perception instead of reality. In a very general sense, “conflict on the trail can occur whenever people perceive unacceptable differences between themselves and another group. These differences can be as rudimentary as lifestyle and social values, or as specific as choice of clothing, camping spot, or behavior on the trail.” (Managing Mountain Biking, IMBA’S Guide to Providing Great Riding, p 136). Additionally, research findings conducted by Jacob & Schreyer, Roger Moore, Jennifer Hoger & Deborah Chavez point out facts such as:

- Conflicts can occur among different user groups, within the same user group, and due to factors unrelated to trail activity.
- Conflict can be felt or perceived even when there is no actual contact between trail users.
- Conflict can be seen as a difference between perceived “low impact” passive users and “high impact” aggressive users.
- User conflict is a matter of perception and varies from person to person.

Research also demonstrates that effective trail management can mitigate conflict situations; there are many practical and proven solutions to conflict when it occurs or is anticipated. Some examples of solutions to user conflict are as follows:

- Information and education
- Signs
- Setting appropriate expectations for trail users
- Paid and volunteer trail patrols
- Peer education on proper trail behavior
- User involvement and partnerships
- Trail advocacy groups
- User group coalitions
- Volunteer trail work
- Shared-use events
- Designing trails in a way that manages speed

- Providing adequate trail opportunities
- Providing diverse trail experiences
- Spreading users throughout trail systems
- Regulations
- Fair and logical trail access policies
- Rules of the trail
- Open communication with all user groups
- Single-use trails
- One-way trails
- Alternating day user restrictions
- Speed limits

It is essential to stress that alleged or potential conflict should not be used as justification for denying or failing to move forward on a change in trail use request.

For additional consideration of trail conflict and the research conducted on its causes and solutions, please refer to the following sampling of studies:

- Hoger & Chavez (1998). Conflict and management tactics on the trail. Parks & Recreation, 33(9), 41-49.
- Moore, (1994). Conflicts on Multiple-Use Trails: Synthesis of Literature and State of Practice. Washington, D.C.: Federal Highway Administration.
- Ramthum (1995). Factors in user group conflict between hikers and mountain bikers. Leisure Sciences, 17(3), 159-170
- Schneider (2000). Revisiting and revising recreation conflict research. Journal of Leisure Research, 32(1), 129-132.
- Vaske, Donnelly, Karin & Laidlaw (1995). Interpersonal versus social-values conflict. Leisure Sciences, 17(3), 205-222

6. One of the background documents for the PEIR is the Trail Use Change Survey that was prepared in 2008. The PEIR should differentiate between those aspects of the Survey that properly deal with environmental impacts, from those that deal with more “social” impacts and thus are not appropriate in the PEIR. The PEIR needs to develop best management practices for trail construction, re-routing and maintenance and the impacts resulting from such activities, which include “social” impacts. This will enable individual parks to efficiently and effectively undertake trail conversion projects without having to undertake additional costly and time consuming CEQA compliance reviews.

7. The Trail Use Change Survey refers to evidence of “unauthorized trail use”, Section 2.4. It is not clear as to just how this information will be used and interpreted. There can be many reasons for unauthorized trail use by mountain bikers. It can result from cyclists being arbitrarily excluded from trails, failure to provide desired trails, or the need for more legitimate trail access. In most cases, unauthorized trail use will not be diminished unless the root causes are identified and dealt with in a constructive manner.

8. The Trail Use Change Survey, Section 7.12 refers to potential workload increase due to a proposed change in use. The perceived potential workload increase should not be used to determine whether a trail is appropriate for multi-use, or a reason to deny access to one user group. Ongoing maintenance workload is a separate issue, and can be addressed in a variety of ways such as changes in budget allocations, grants, volunteerism, adopt a trail programs, etc.

9. The concept of “Change in Use” should be clearly expanded to include situations where a new trail, re-routing of an existing trail, or extensive rehabilitation of an existing trail is necessary.

Probable Environmental Effects & Mitigations

- Terrestrial Biological Resources

- Aquatic Biological Resources
- Geology, Soils, and Mineral
- Hydrology, Water Quality, and Erosion/Sedimentation
- Hazards (user safety)

1. It is important to point out in the PEIR that every user group impacts the trail. The challenge in all trail construction and trail modifications is to make trails sustainable. Sustainable trails have minimal impact to the environment, resist erosion through proper design, construction and maintenance, and blend in with surrounding natural areas. The field of trail engineering and construction has evolved to the point today where professional trail builders are able employ a variety of techniques that mitigate the potential stresses to trails and the surrounding environment. It is now understood that the greatest determinant of sustainable trails is the design and construction of the trail itself as opposed to the type of trail user. The following considerations and trail engineering techniques are a sample listing of mitigation measures (best practices) that are suitable for inclusion in the PEIR, as discussed above in paragraph 1 of General Measures.

- Rolling contours
- Controlling grade (maximum sustainable trail grade)
- Avoid fall line trails
- Avoid flat areas
- Out slope trails
- Grade reversals
- Tread width considerations
- Tread surface composition
- Soil/geotechnical analyses to identify potential problem areas and engineering solutions
- Natural obstacles
- Choke points
- Overall trail design
- Potential trail user (type and numbers)
- Low- or no-impact wetland and water crossings
- Configured loops
- Trail flow or sinuosity
- Trail connectivity
- Vegetation analysis
- Bench cut trails
- Use of hand and mechanized tools
- Switchback construction
- Retaining walls
- Armoring with rock
- Soil hardeners
- Culverts
- Bridges
- Trail drainage
- Trail re-route

2. The PEIR must make use of the body of information and research that deals with the relative environmental impact of different user groups in the trail community. The common environmental impacts associated with recreational trails are:

- Vegetation loss and compositional changes (e.g., spread of invasive species)
- Soil compaction
- Erosion
- Loss of soil structure
- Degraded water quality

- Disruption of wildlife

Mountain biking, like most recreation activities, does impact the environment. However, there are conflicting perceptions in some instances as to the degree of impact to soils, wildlife and vegetation caused by bicycles as opposed to other users such as hikers, runners and equestrians. Fortunately there is a body of empirical, scientific evidence that indicates that mountain biking is no more damaging than other forms of recreation including hiking. Land managers who prohibit bicycle use, while allowing hiking or equestrian use are acting without sound scientific backing. The following are some examples of research conducted that compare the effects of bicyclists with other trail users.

- Marion & Wimpey, (2007). Environmental Impacts of Mountain Biking: Science Review and Best Practices. Originally published in Managing Mountain Biking: IMBA's Guide to Providing Great Riding (2007).
- Bjorkman, Alan. 1996. Off Road Bicycle and Hiking Trail User Interactions: A Report to the Wisconsin Natural Resources Board. Wisconsin Department of Natural Resources: Bureau of Research.
- Chiu, Luke and Kriwoken, Lorne. Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia. *Annals of Leisure Research*, (in press).
- Crockett, Christopher S. 1986. Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park. Santa Clara County (CA) Parks Department.
- Gander, Hans and Ingold, Paul. 1996. Reactions of Male Alpine Chamois Rupicapra r.rupicapra to Hikers, Joggers and Mountainbikers. *Biological Conservation* 79:107 - 109.
- Goeft, Ute and Alder, Jackie. 2001. Sustainable Mountain Biking: A Case Study from the Southwest of Western Australia. *Journal of Sustainable Tourism* 9(3): 193 - 211.
- Herrero, Jake and Herrero, Stephen. 2000. Management Options for the Moraine Lake Highline Trail: Grizzly Bears and Cyclists.
- Papouchis, Christopher M. and Singer, Francis J. and Sloan, William. 2001. Responses of Desert Bighorn Sheep To Increased Human Recreation. *Journal of Wildlife Management* 65(3): 573 - 582.
- Spahr, Robin. 1990. Factors Affecting The Distribution Of Bald Eagles And Effects Of Human Activity On Bald Eagles Wintering Along The Boise River. Boise State University.
- Taylor, Audrey R. and Knight, Richard L. 2003. Wildlife Responses to Recreation and Associated Visitor Perceptions. *Ecological Applications* 13(4): 951 - 963.
- Thurston, Eden and Reader, Richard J. 2001. Impacts of Experimentally Applied Mountain Biking and Hiking on Vegetation and Soil of a Deciduous Forest. *Environmental Management* 27(3): 397 - 409.
- Weesner, Meg. 2003. Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona, National Park Service.
- Wilson, John P. and Seney, Joseph. 1994. Erosional Impacts of Hikers, Horses, Motorcycles and Off-Road Bicycles on Mountain Trails in Montana. *Mountain Research and Development* 47(1): 77 - 88.

3. The scope of the PEIR should include potential safety concerns among different trails users, and the steps that can be taken to insure a pleasant and safe experience for all trail users. The addition of bikes to existing trails can produce degrees of uneasiness among other trail users. Because bikes have the potential to operate at greater speeds than other trail users, non-bikers can have concerns of being run into and injured by fast moving cyclists. The quiet operation of bikes can startle other trail users, and in the case of horses can cause a startle and fleeing response. In addition, some cyclists are not familiar with the behavior of horses and do not understand how to act around them to decrease the likelihood of an accident. The following are examples of mitigation measures that can be taken to manage safety on trails:

- Provide public education on proper trail etiquette
- Provide trail yield instruction signs at all multi-use trailheads
- Provide directional signage

- Conduct multi-use trail workshops
- Conduct horse desensitization sessions
- Work with bike shops, schools, clubs, and outdoor stores to promote low impact riding.
- Park trailhead interpreters to pass out information on proper trail behavior
- Mobilize bike-equestrian patrols
- Increase staff patrol
- Cite violators of trail regulations
- Design trails for speed control (narrow trails, pinch points, obstacles, rough surfaces)
- Design trails for safe passing (strategically placed widened areas, pull out zones)
- Line of sight modifications
- Re-route trails
- Build new trails
- Alternate use restrictions, i.e. bikes one day, horses and walkers another day
- Alternate use by time of day
- Adherence to trail maintenance schedules
- Adopt-a-trail for maintenance by volunteers
- Require cyclists and equestrians to wear helmets
- Disperse use by opening more trails
- Separate trailheads for a central trail system
- Partnerships and MOUs with user groups
- Promote multi-use events, i.e. barbecues, poker rides, trail building, volunteer celebrations
- Use walk your bike zones
- Create multi-use trail advisory committees
- Designate "high speed" trails and "low speed" trails
- Use "stacked loop" trail system design to disperse users
- Keep trails narrow to slow users and reduce environmental impact
- Prohibit off trail travel
- Design trails with sustainable grades
- Use a trail permit/pass system to control trail carrying capacity (permits issued according to proportional size of user group)
- Deploy rangers on bikes and horses in parks.
- Close trails to horses when other less drastic measures have failed
- Close trails to bikes when other less drastic measures have failed

It is our hope that a properly constructed PEIR will enable State Parks to provide strong leadership in meeting the increasing public demand for more trail access throughout the State Park System. Park Districts need to have the tools that will enable them to respond efficiently and effectively to requests for trail use changes, and to properly resist the unfounded objections of those who may oppose any change in the status quo. A robust PEIR will provide these tools, and will help State Parks achieve its dual mandates of environmental protection and recreational access.

We appreciate the opportunity to provide input to this important process.

Sincerely,

Tom Ward
IMBA California Policy Director

From: CEQA NSC
Sent: Thursday, December 02, 2010 10:29 AM
To: West, Heidi
Subject: BSmith_Bay Area Ridge Tr Council_11-30-10

Attachments: Trail change PEIR ltr.pdf
FYI

From: Bern Smith [bernsmith@ridgetrail.org]
Sent: Tuesday, November 30, 2010 5:08 PM
To: CEQA NSC
Cc: Janet McBride; Dee Swanhuyser
Subject: Trails PEIR

Greetings --

Attached please find our comments concerning the proposed PEIR for road and trail use changes in state parks.

Regards --

--
Bern Smith
South Bay Trail Director
Bay Area Ridge Trail Council
bernsmith@ridgetrail.org
415 561 2595 office
650 868 5467 cell
1007 General Kennedy #3
San Francisco 94129

BAY AREA
RIDGE TRAIL
COUNCIL

Environmental Coordinator – Trails PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

30 November 2010

Re: PEIR for Road & Trail Conversion in California State Parks

Greetings --

The Bay Area Ridge Trail Council (Council) is very interested in the proposed Programmatic Environmental Impact Report (PEIR) and Trail Use Change Evaluation currently being developed by State Parks, for several reasons:

- The Council is committed to creating a safe and environmentally sound multi-use ridgeline trail circling the San Francisco Bay, connecting the region's parks and open spaces for hikers, mountain bicyclists and equestrians
- the Ridge Trail currently crosses 8 State Parks
- Ridge Trail segments are among the first in the state to be evaluated under the proposed use change policy
- the Ridge Trail is a Designated State Trail Corridor (California Recreational Trails Plan)

We have been closely involved in the PEIR and use change policy planning, attending several workshops and field sessions to test the draft survey form. We also have worked closely with Santa Cruz District staff to develop the Castle Rock State Park Skyline Trail upgrade plan that is serving as a test case for the proposed policy.

Please accept the following comments regarding the PEIR and Trail Use Change Evaluation.

Range of actions

Adopting the proposed trail use change policy should help State Parks implement a goal set forth in the State Recreational Trails Plan, to "provide the maximum opportunities for the public use of trails by encouraging the appropriate expansion of

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multi-use trails." In support of this goal, the Council recommends adoption of the draft "Trail Use Change Survey" checklist, with suggested changes/additions described under 'methods of assessment" below.

Alternatives

A "parallel" trail option (i.e., possible alignment for **new** trail that would make the desired connections for all users) should be considered if the use change evaluation does not support adding use on an existing route. This consideration would be separate from the provision for "major realignment" already noted in the checklist. We understand that the CEQA process likely would be triggered should a new trail route be planned.

Methods of assessment

We suggest the following additions to the survey evaluation criteria checklist:

#2 Compatibility: add "Is the trail part of a regional trail route that supports additional uses in other jurisdictions?"

#3 Affects to Circulation Patterns: add "Does the change close a "use gap" in a longer, regional trail?"

In the Ridge Trail Council's experience, most communities and most trails will support multiple uses. Determining how well trails within a region are being "shared" by various use groups will be critical to understanding what can be expected to occur when a trail is opened to additional types of use. Surveying park visitors regarding their satisfaction with existing shared use trails should help determine what issues, if any, may arise when a use is added.

When analyzing existing trail conditions and possibilities to upgrade specific trail segments, wide variations in local conditions will be identified. This suggests it would be prudent to avoid rigid parameters for trail width, slope, rise, tread, etc. For example, Council guidelines for Ridge Trail dimensions include widths as narrow as 18 in. for narrow single track, and as wide as 20 ft. for ranch and fire roads. Survey of nearby trails that sustainably support the proposed additional use could help to determine appropriate design parameters.

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Environmental effects

We recommend preserving the CEQA exemption for routine maintenance by providing clear differentiation between maintenance and major realignment or upgrade. Thus, routine maintenance, even in support of adding a use, would not by itself trigger additional environmental review.

Assessing potential impacts due to changes in use can be difficult, and in many cases the discussion about impacts may focus primarily on perceptions of the trail users, rather than empirical evidence. Further, except for demonstrably major impacts such as increased noise due to adding motorcycling to an otherwise non-motorized trail route, the most significant impact to the environment may be the existing trail itself. Beyond that, the absolute number of trail users may be a better indicator of potential impacts than the type of use proposed. Surveys of park visitors, representatives of various groups of trail users, and park staff might provide answers to questions regarding how many additional trail visits may occur.

Mitigation measures to be analyzed

In addition to impact mitigation activities such as interpreting shared use, placing "traffic calming" devices in the trail, alternating use days, and designating uphill-only routes, it should be noted that use changes themselves might mitigate certain environmental impacts. Examples could include:

- reducing vehicle trips if, by opening a trail for additional uses, more visitors have direct park access without the need for a vehicle
- reducing the number of interactions between trail users on any individual route by distributing park visitors over a broader area
- increasing the pool of volunteers available for trail maintenance, monitoring and restoration

Thank you for the opportunity to add our comments on this important policy issue. We will follow the progress of this program and provide additional comments and support when appropriate.

Regards --

Bern Smith

South Bay Trail Director

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From: CEQA NSC
Sent: Tuesday, November 30, 2010 10:33 AM
To: West, Heidi
Subject: GGrady_SDMBA_11-30-10

Attachments: 2007_MTB-impacts_Marion.pdf; ATT00001..htm; CSP_PEIR_comment01.pdf; ATT00002..htm

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From: Gardner Grady [gggraphx@cox.net]
Sent: Tuesday, November 30, 2010 10:28 AM
To: CEQA NSC
Cc: Russ Boggs MB
Subject: Trails PEIR

Environmental Coordinator Trails PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814
Comments submitted by email should be sent to: ceqansc@parks.ca.gov

Thank you for considering our comments during the scoping period for the State Parks Roads and Trails Change-in-Use Program environmental impact report (PEIR). One of our members, Russ Boggs, attended the scoping meeting in Perris in November.

Our understanding is that the California State Parks (CSP) is using this PEIR to develop an overall framework and consistent approach to changing the use designation on roads and trails. We applaud the CSP for undertaking this project. California's population continues to increase, and the CSP system needs to keep pace with providing its increased number of residents with "opportunities for high-quality outdoor recreation" as stated in CSP's mission statement (CSP website: "Our Mission" www.parks.ca.gov/?page_id=91; accessed on November 27, 2010).

Additionally, it appears that the users of California SP are increasing in their diversity; this increased diversity includes how they choose to enjoy their time outdoors. Thirty years ago, virtually the only non-motorized travelers on state park trails were hikers, runners and horseback riders. Today, a relatively new group of users, mountain bikers, have come to enjoy the backcountry regions of state parks. Unfortunately, they are excluded from large numbers of trails. For one thing, mountain bikers are permanently excluded from regions of state parks that are also designated as wilderness areas, (e.g., Rancho Cuyamaca State Park). There are other trails, however, within state parks that could be used by bicyclists if the use designation was changed. At the same time, as far as we know, there are few or no trails within the CSP system where MTBs have exclusive rights of access or are even favored.

Given that the population of California will continue to increase, increased numbers of residents will result in increased use of trails. It's important to expose our diverse California population to the variety of landscapes of the CSP system.

In evaluating the environmental impact of additional trail users, or the environmental impact of a allowing a different class of trail users, the study should focus, at least in part, on the per capita impact. For example, would an individual mountain biker have a greater impact on the trail/environment than an individual hiker? Some studies have found that a hiker or a bicyclist have an equivalent impact on soil erosion, and both have less impact than a horse (see attachments).

Additionally, some consideration should be given to the potential that if a trail is opened to mountain bikes, the usage of other trails used by mountain bikes within the same state park may decrease, and therefore, if indeed there is actually any environmental effect to opening a trail to a new class of users, such an opening may self-mitigate. As an example, if a second trail is opened at the farthest reach of the popular loop, that might decrease use of a first trail.

As much as possible, environmental analysis should take advantage of, and be based on, research publications in the field. For example, some studies suggest mountain bicyclists are less disruptive to wildlife possibly because they are less likely to stop and examine individual animals (i.e., staring and pointing). Also, mountain bicyclists are more likely to stay on the trail than other users, therefore confining the physical environmental impact to just the trail itself.

We have included with this letter a PDF and links from the International Mountain Bicycling Association's (IMBA) website (under resources) representing analysis of recent publications concerning the impact of recreational use on park-like areas. Citations to the actual research papers are contained within PDFs. We would be happy to help you obtain copies of the original papers if it would help you.

In conclusion, it is important to allow use of the CSP system by a diverse group of users. Currently we have a perception that certain user groups are favored in terms of trail use within the CSP system, especially when the wilderness areas are included. Access to the trail system within the CSP should be adjusted to provide equal access to the trail system of all users regardless of their chosen means of recreation.

Our contacts for questions or comments are:
Russell Boggs

NOP Comment Letter O-11

619-248-6237
rboggs.mb@gmail.com
and Gardner Grady

Thank you for your consideration,
Gardner Grady

President, San Diego Mountain Biking Association
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Environmental Impacts of Mountain Biking: Science Review and Best Practices

By Jeff Marion and Jeremy Wimpey

This article was originally published in [Managing Mountain Biking: IMBA's Guide to Providing Great Riding](/resources/science/../bike_management/managing_mountain_bikes.html) (/resources/science/../bike_management/managing_mountain_bikes.html) , a 256-page book produced by IMBA in 2007. The book offers an essential collection of best practices for planning, designing, and managing successful trail networks and parks. Managing Mountain Biking is a companion to IMBA's trailbuilding how-to book [Trail Solutions](/resources/science/../trail_building/trail_solutions.html) (/resources/science/../trail_building/trail_solutions.html) . Both are available at http://www.imba.com (http://www.imba.com) .

Mountain biking is still a relatively new activity whose environmental impact and contribution to trail degradation is poorly understood. As with all recreational pursuits, it is clear that mountain biking contributes some degree of environmental degradation. In the absence of adequate research, land and trail managers have frequently been cautious, implementing restrictive regulations in some instances (Edger 1997). Surveys of managers have shown that they frequently perceive mountain biking to be a substantial contributor to trail degradation but lack scientific studies or monitoring data to substantiate such concerns (Chavez and others 1993; Schuett 1997). In recent years, however, a small number of studies have been conducted that help clarify the environmental impacts associated with mountain biking. This article describes the general impacts associated with recreational uses of natural surface trails, with a focus on those studies that have examined mountain biking impacts.

Trails are generally regarded as essential facilities in parks and forests. They provide access to remote areas, accommodate a diverse array of recreational activities, and protect resources by concentrating visitor trampling on narrow and resistant tread surfaces. Formal or designated trails are generally designed and constructed, which involves vegetation removal and soil excavation. These changes may be considered "unavoidable," in contrast to "avoidable" post-construction degradation from their subsequent use (e.g., trail widening, erosion, muddiness), or from the development and degradation of informal visitor-created trails.

Common environmental impacts associated with recreational use of trails include:

- Vegetation loss and compositional changes
- Soil compaction
- Erosion
- Muddiness
- Degraded water quality
- Disruption of wildlife

This article is organized into four broad categories: impacts to vegetation, soil, water, and wildlife.

Impacts to Vegetation: General Research

On formal trails, most vegetation is typically removed by construction, maintenance, and visitor use. This impact is necessary and "unavoidable" in order to provide a clear route for trail users. One goal of trail construction and maintenance is to provide a trail only wide enough to accommodate the intended use. Trails made wider than this through visitor use or erosion represent a form of "avoidable" impact. For example, a doubling of trail width represents a doubling of the area of intensive trampling disturbance. Wider trails also expose substantially greater amounts of soil to erosion by wind or water.

The creation and maintenance of trail corridors also removes shrubs and trees, allowing greater sunlight exposure that favors a different set of groundcover plants within trail corridors. Occasional trailside trampling within trail corridors also favors the replacement of fragile plants with those more resistant to trampling traffic. For example, shade-tolerant but fragile broadleaved herbs are frequently replaced by grasses and sedges that are trampling-resistant and require more sunlight to survive. Trail construction, use, and maintenance can also be harmful when trails divide sensitive or rare plant communities.

Trampling - the action of crushing or treading upon vegetation, either by foot, hoof, or tire - contributes to a wide range of vegetation impacts, including damage to plant leaves, stems, and roots, reduction in vegetation height, change in the composition of species, and loss of plants and vegetative cover (Leung & Marion, 1996; Thurston & Reader, 2001). Trampling associated with "avoidable" off-trail traffic can quickly break down vegetation cover and create a visible route that attracts additional use. Complete loss of vegetation cover occurs quickly in shady forested areas, less quickly in open areas with resistant grassy vegetation. Regardless, studies have consistently revealed that most impact occurs with initial or low use, with a diminishing increase in impact associated with increasing levels of traffic (Hammit & Cole, 1998; Leung & Marion, 1996). Furthermore, once trampling occurs, vegetative recovery is a very slow process.

Compositional changes in the vegetation along trail corridors can have both beneficial and adverse effects. Trampling-resistant plants provide a durable groundcover that reduces soil loss by wind and water runoff, and root systems that stabilize soils against displacement by heavy traffic. The ecological impacts of such compositional changes are not fully known, except when non-native vegetation is introduced to and spreads along trail corridors. Many of these species are disturbance-associated and are naturally limited to areas where the vegetation is routinely trampled or cut back. However, a few non-native species, once introduced to trail corridors, are able to out-compete native plants and spread away from the trail corridor in undisturbed habitats. Some of these species form dense cover that crowd out or displace native plants. These "invasive" species are particularly undesirable and land managers actively seek to prevent their introduction and spread. Unfortunately their removal is difficult and expensive.

Impacts to Vegetation: Mountain Biking-Specific Research

Only one study found specifically addresses the vegetation impacts associated with mountain biking. Thurston and Reader (2001) conducted an experimental trampling study involving mountain bikers and hikers in Boyne Valley Provincial Park of Ontario, Canada. The researchers measured plant density (number of stems/area), diversity (number of species present), and soil exposure (area of mineral soil exposed) before and after 500 one-way passes by bikers and hikers.

Data analysis and statistical testing revealed that the impacts of hiking and biking were not significantly different for the three indicators measured. They also concluded that impacts from both hikers and bikers were spatially confined to the centerline of the lane (trail).

Impacts to Vegetation: Management Implications

Trail managers can either avoid or minimize impacts to vegetation through careful trail design, construction, maintenance, and management of visitor use. Here are some recommendations to reduce vegetation impacts:

- Design trails that provide the experience that trail users seek to reduce their desire to venture off-trail.
- Locate trails away from rare plants and animals and from sensitive or critical habitats of other species. Involve resource professionals in designing and approving new trail alignments.
- Keep trails narrow to reduce the total area of intensive tread disturbance, slow trail users, and minimize vegetation and soil impacts.
- Limit vegetation disturbance outside the corridor when constructing trails. Hand construction is least disruptive; mechanized construction with small equipment is less disruptive than full-sized equipment; skilled operators do less damage than those with limited experience.
- Locate trails on side-hills where possible. Constructing a side-hill trail requires greater initial vegetation and soil disturbance but sloping topography above and below the trail bench will clearly define the tread and concentrate traffic on it. Trails in flatter terrain or along the fall line may involve less initial disturbance but allow excessive future tread widening and off-tread trampling, which favor non-native plants.
- Use construction techniques that save and redistribute topsoil and excavated plants.

There are also important considerations for maintaining and managing trails to avoid unnecessary ongoing impacts to vegetation:

- While it is necessary to keep the trail corridor free of obstructing vegetation, such work should seek to avoid "day-lighting" the trail corridor when possible. Excessive opening of the overstory allows greater sunlight penetration that permits greater vegetation compositional change and colonization by non-native plants.
- An active maintenance program that removes tree falls and maintains a stable and predictable tread also encourages visitors to remain on the intended narrow tread. A variety of maintenance actions can discourage trail widening, such as only cutting a narrow section out of trees that fall across the trail, limiting the width of vegetation trimming, and defining trail borders with logs, rocks, or other objects that won't impede drainage.
- Use education to discourage off-trail travel, which can quickly lead to the establishment of informal visitor-created trails that unnecessarily remove vegetation cover and spread non-native plants. Such routes often degrade rapidly and are abandoned in favor of adjacent new routes, which unnecessarily magnify the extent and severity of trampling damage.
- Educate visitors to be aware of their ability to carry non-native plant seeds on their bikes or clothing, and encourage them to remove seeds by washing mud from bikes, tires, shoes, and clothing. Preventing the introduction of non-natives is key, as their subsequent removal is difficult and costly.
- Educate visitors about low impact riding practices, such as those contained in the IMBA-approved Leave No Trace Skills & Ethics: Mountain Biking booklet (www.LNT.org (http://www.LNT.org)).

For further reading see: Cessford 1995; Gruttz and Hollingshead 1995; Thurston and Reader 200l.

Impacts to Soils: General Research

The creation and use of trails also results in soil disturbance. Some loss of soil may be considered an acceptable and unavoidable form of impact on trails. As with vegetation loss, much soil disturbance occurs in the initial construction and use of the trail. During trail construction, surface organic materials (e.g., twigs, leaves, and needles) and organic soils are removed from treads; trails built on sidehill locations require even more extensive excavation. In addition, the underlying mineral soils are compacted during construction and initial use to form a durable tread substrate that supports trail traffic.

In contrast, post-construction soil displacement, erosion, and muddiness represent core forms of avoidable trail impact that require sustained management attention to avoid long-lasting resource degradation. This degradation can reduce the utility of trails as recreation facilities and diminish the quality of visitor experiences. For example, soil erosion exposes rocks and plant roots, creating a rutted and uneven tread surface. Erosion can also be self-perpetuating when treads erode below the surrounding soil level, hindering efforts to divert water from the trail and causing accelerated erosion and muddiness. Similarly, excessive muddiness renders trails less usable and aggravates tread widening and associated vegetation loss as visitors seek to circumvent mud holes and wet soils (Marion, 2006).

Research has shown that visitors notice obvious forms of trail impact, such as excessive muddiness and eroded ruts and tree roots, and that such impacts can degrade the quality of visitor experiences (Roggenbuck and others., 1993; Vaske and others., 1993). Such conditions also increase the difficulty of travel and may threaten visitor safety. Remedying these soil impacts can also require substantial rehabilitation costs. Clearly, one primary trail management objective should be the prevention of excessive soil impacts. Let's examine four common forms of soil impact in greater detail:

The Four Common Forms of Soil Degradation on Trails:

- Compaction
- Muddiness
- Displacement
- Erosion

Compaction: Soil compaction is caused by the weight of trail users and their equipment, which passes through feet, hooves, or tires to the tread surface.

Compacted soils are denser and less permeable to water, which increases water runoff. However, compacted soils also resist erosion and soil displacement and provide durable treads that support traffic. From this perspective, soil compaction is considered beneficial, and it is an unavoidable form of trail impact. Furthermore, a primary resource protection goal is to limit trailside impacts by concentrating traffic on a narrow tread. Success in achieving this objective will necessarily result in higher levels of soil compaction.

The process of compacting the soil can present a difficult challenge, especially on new trails. Unless soils are mechanically compacted during tread construction, initial use compacts the portions of the tread that receive the greatest traffic, generally the center. The associated lowering of the tread surface creates a cupped cross-section that intercepts and collects surface water. In flat terrain this water can pool or form muddy sections; in sloping terrain the water is channeled down the trail, gaining in volume, speed, and erosive potential.

Displacement: Trail users can also push soil laterally, causing displacement and development of ruts, berms, or cupped treads. Soil displacement is particularly evident when soils are damp or loose and when users are moving at higher rates of speed, turning, braking, or other movements that create more lateral force. Soil can also be caught in hooves, footwear, or tire treads, flicked to the side or carried some distance and dropped. Regardless of the mechanism, soil is generally displaced from the tread center to the sides, elevating inslopes or berms, and compounding drainage problems.

Muddiness: When trails are located in areas of poor drainage or across highly organic soils that hold moisture, tread muddiness can become a persistent problem. Muddiness is most commonly associated with locations where water flows across or becomes trapped within flat or low-lying areas. Soil compaction, displacement, and erosion can exacerbate or create problems with muddiness by causing cupped treads that collect water during rainfall or snowmelt. Thus, muddiness can occur even along trails where there is sufficient natural drainage. Subsequent traffic skirts these problem spots, compacting soils along the edges, widening mud holes and tread width, and sometimes creating braided trails that circumvent muddy sections.

Erosion: Soil erosion is an indirect and largely avoidable impact of trails and trail use. Soil can be eroded by wind, but generally, erosion is caused by flowing water. To avoid erosion, sustainable trails are generally constructed with a slightly crowned (flat terrain) or outsloped (sloping terrain) tread. However, subsequent use compacts and/or displaces soils over time to create a cupped or insloped tread surface that intercepts and carries water. The concentrated run-off picks up and carries soil particles downhill, eroding the tread surface.

Loose, uncompacted soil particles are most prone to soil erosion, so trail uses that loosen or detach soils contribute to higher erosion rates. Erosion potential is closely related to trail grade because water becomes substantially more erosive with increasing slope. The size of the watershed draining to a section of trail is also influential - larger volumes of water are substantially more erosive.

Water and the sediment it carries will continue down the trail until a natural or constructed feature diverts it off the tread. Such features include a natural or constructed reversal in grade, an outsloped tread, rocks or tree roots, or a constructed drainage dip or water bar. Once the water slows, it drops its sediment load, filling in tread drainage features and causing them to fail if not periodically maintained. Sediment can also be carried directly into watercourses, creating secondary impacts to aquatic systems. Properly designed drainage features are designed to divert water from the trail at a speed sufficient to carry the sediment load well below the tread, where vegetation and organic litter can filter out sediments. A well-designed trail should have little to no cumulative soil loss, for example, less than an average of one-quarter inch (6.3 mm) per year.

Impacts to Soils: Mountain Biking-Specific Research

Several studies have evaluated the soil impacts of mountain biking.

Wilson and Seney (1994) evaluated tread erosion from horses, hikers, mountain bikes, and motorcycles on two trails in the Gallatin National Forest, Montana. They applied one hundred passes of each use-type on four sets of 12 trail segments, followed by simulated rainfalls and collection of water runoff to assess sediment yield at the base of each segment. Control sites that received no passes were also assessed for comparison. Results indicated that horses made significantly more sediment available for erosion than the other uses, which did not significantly vary from the control sites. Traffic on pre-wetted soils generated significantly greater amounts of soil runoff than on dry soils for all uses.

Marion (2006) studied 78 miles (125 km) of trail (47 segments) in the Big South Fork National River and Recreation Area, Tennessee and Kentucky, measuring soil loss along transects across the trail to evaluate the influence of use-related, environmental, and management factors. Sidehill-aligned trails were significantly less eroded than trails in valley bottom positions, in part due to the influence of periodic floods. Trail grade and trail alignment angle were also significant predictors of tread erosion. Erosion rates on trails with 0-6 percent and 7-15 percent grades were similar, while erosion on trails with grades greater than 16 percent were significantly higher. And there was significantly greater erosion on fall line trails (alignment angles of 0-22 degrees) than those with alignments closer to the contour.

This study also provided an opportunity to examine the relative contribution of different use types, including horse, hiking, mountain biking, and ATV. Trails predominantly used for mountain biking had the least erosion of the use types investigated. Computed estimates of soil loss per mile of trail also revealed the mountain biking trails to have the lowest soil loss.

White and others (2006) also examined trails predominantly used for mountain biking in five ecological regions of the Southwest along 163 miles (262 km) of trail. Two trail condition indicators, tread width and maximum incision, were assessed at each sample point. Results show that erosion and tread width on these trails differed little in comparison to other shared-use trails that receive little or no mountain biking.

Goeft and Alder (2001) evaluated the resource impacts of mountain biking on a recreational trail and racing track in Australia over a 12-month period. A variety of trail condition indicators were assessed on new and older trail segments with uphill, downhill, and flat trail sections. Results found that trail slope, age, and time were significant erosion factors, and that downhill slopes and curves were the most susceptible to erosion. New trails experienced greater amounts of soil compaction but all trails exhibited both compaction and loosening of soils over time. The width of the recreational trail varied over time, with no consistent trend, while the width of the racing trail grew following events but exhibited net recovery over time. Impacts were confined to the trail tread, with minimal disturbance of trailside vegetation.

Bjorkman (1996) evaluated two new mountain biking trails in Wisconsin before and for several years after they were opened to use. Vegetation cover within the tread that survived trail construction work declined with increasing use to negligible levels while trailside vegetation remained constant or increased in areas damaged by construction work. Similarly, soil compaction within the tread rose steadily while compaction of trailside soils remained constant. Vegetation and soil impacts occurred predominantly during the first year of use with minor changes thereafter.

Wohrstein (1998) evaluated the impacts from a World Championship mountain biking race with 870 participants and 80,000 spectators. Erosion was found only on intensively used racing trails in steep terrain where alignments allowed higher water runoff. The mountain biking routes exhibited higher levels of compaction but to a shallower depth in comparison to the spectator areas, where compaction was lower but deeper.

Cessford (1995) provides a comprehensive, though dated, summary of trail impacts with a focus on mountain biking. Of particular interest is his summary of the two types of forces exerted by bike tires on soil surfaces: The downward compaction force from the weight of the rider and bike, and the rotational shearing force from the turning rear wheel. Mountain bikers generate the greatest torque, with potential tread abrasion due to slippage, during uphill travel. However, the torque possible from muscle power is far less than that from a motorcycle, so wheel slippage and abrasion occur only on wet or loose surfaces. Tread impact associated with downhill travel is generally minimal due to the lack of torque and lower ground pressures. Exceptions include when riders brake hard enough to cause skidding, which displaces soil downslope, or bank at higher speeds around turns, which displaces soil to the outside of the turn. Impacts in flatter terrain are also generally minimal, except when soils are wet or uncompacted and rutting occurs.

Impacts to Soils: Management Implications

Soil loss is among the most enduring forms of trail impact, and minimizing erosion and muddiness are the most important objectives for achieving a sustainable trail. Soil cannot easily be replaced on trails, and where soil disappears, it leaves ruts that make travel and water drainage more difficult, prompting further impacts, such as trail widening.

Existing studies indicate that mountain biking differs little from hiking in its contribution to soil impacts. Other factors, particularly trail grade, trail/slope alignment angle, soil type/wetness, and trail maintenance, are more influential determinants of tread erosion or wetness.

There are a number of tactics for avoiding the worst soil-related impacts to trails:

- Discourage or prohibit off-trail travel. Informal trails created by off-trail travel frequently have steep grades and fall-line alignments that quickly erode, particularly in the absence of tread maintenance. Exceptions include areas of solid rock or non-vegetated cobble.
- Design trails with sustainable grades and avoid fall-line alignments. (See p. 112 for more)
- When possible, build trails in dry, cohesive soils that easily compact and contain a larger percentage of coarse material or rocks. These soils better resist erosion by wind and water or displacement by feet, hooves and tires.
- Minimize tread muddiness by avoiding flat terrain, wet soils, and drainage-bottom locations.
- Use grade reversals to remove water from trail treads. Grade reversals are permanent and sustainable - when designed into a trail's alignment they remain 100 percent effective and rarely require maintenance.

Other strategies are more temporary in nature and will require periodic maintenance to keep them effective:

- While the use of a substantial outslope (e.g., 5 percent) helps remove water from treads, it is rarely a long-term solution. Tread cupping and berm development will generally occur within a few years after tread construction. If it is not possible to install additional grade reversals, reshape the tread to reestablish an outsloped tread surface periodically, and install wheel-friendly drainage dips or other drainage structures to help water flow off the trail.
- If it is not possible to install proper drainage on a trail, consider rerouting trail sections that are most problematic, or possibly hardening the tread.
- In flatter areas, elevate and crown treads to prevent muddiness, or add a gravel/soil mixture in low spots.

Finally, it is important to realize that visitor use of any type on trails when soils are wet contributes substantially greater soil impact than the same activities when soils are dry. Thus, discouraging or prohibiting the use of trails that are prone to muddiness during rainy seasons or snowmelt is another effective measure. Generally such use can be redirected to trails that have design or environmental attributes that allow them to better sustain wet season uses.

For additional information about minimizing soil impacts through trail design, construction, maintenance, and tread hardening, see Trail Solutions.

Impacts to Water Resources: General Research

Trails and their use can also affect water quality. Trail-related impacts to water resources can include the introduction of soils, nutrients, and pathogenic organisms (e.g., Giardia), and alter the patterns of surface water drainage. However, in practice, these impacts are avoidable, and properly designed and maintained trails should not degrade water quality. Unfortunately there is very little research to draw from on these topics, and none that is specific to mountain biking.

Poorly sited and/or maintained trails can be eroded by water, with tread sediments carried off by runoff. Generally, if water control features such as grade reversals and outsloped treads are used to divert runoff from trails, the water drops its sediment close to trails, where it is trapped and held by organic litter and vegetation. Soils eroded from trails rarely enter water bodies, unless trails cross streams or run close to stream or lake shorelines and lack adequate tread drainage features. Since many recreational activities, such as fishing, swimming, boating, and viewing scenery (e.g., waterfalls) draw visitors and trails to the vicinity of water resources, it is often necessary to route trails to water resources or visitors will simply create their own informal trails.

Trails that are close to water resources require special consideration in their design and management to prevent the introduction of suspended sediments into bodies of water. Eroded soil that enters water bodies increase water turbidity and cause sedimentation that can affect aquatic organisms (Fritz and others 1993). Trout and other fish lay their eggs in gravels on the bottom of streams and lakes, and sediments can smother those eggs, reducing reproductive success. Sedimentation can also hurt invertebrate organisms, which serve as food for fish and other creatures. In addition, some sediment may contain nutrients that can contribute to algal blooms that deplete the dissolved oxygen in water bodies when they die off.

Poorly designed trails can also alter hydrologic functions - for instance, trails can intercept and divert water from seeps or springs, which serve important ecological functions. In those situations, water can sometimes flow along the tread, leading to muddiness or erosion and, in the case of cupped and eroded treads, the water may flow some distance before it is diverted off the trail, changing the ecology of small wetland or riparian areas.

Trail users may also pollute water with pathogenic organisms, particularly those related to improperly disposed human waste. Potential pathogenic organisms found through surveys of backcountry water sources include Cryptosporidium spp., Giardia spp., and Campylobacter jejuni (LeChevallier and others, 1999; Suk and others, 1987; Taylor and others, 1983). This is rarely a significant concern where trail use is predominantly day-oriented, and waste issues can be avoided by installing toilet facilities or following Leave No Trace practices (i.e., digging cat-holes for waste away from water resources).

Impacts to Water Resources: Management Implications

The same trail design, construction, and maintenance measures that help minimize vegetation and soil impacts also apply to water. But there are also some additional efforts needed to protect water resources:

- Trails should avoid close proximity to water resources. For example, it is better to build a trail on a sidehill along a lower valley wall than to align it through flat terrain along a stream edge, where trail runoff will drain directly into the stream.
- It is best to minimize the number of stream crossings. Where crossings are necessary, scout the stream carefully to select the most resistant location for the crossing. Look for rocky banks and soils that provide durable surfaces.
- Design water crossings so the trail descends into and climbs out of the steam crossing, preventing stream water from flowing down the trail.
- Armor trails at stream crossings with rock, geotextiles, or gravel to prevent erosion.
- Include grade reversals, regularly maintained outsloped treads, and/or drainage features to divert water off the trail near stream crossings. This prevents large volumes of water and sediment from flowing down the trail into the stream, and allows trailside organic litter, vegetation, and soils to slow and filter water.
- On some heavily used trails, a bridge may be needed to provide a sustainable crossing.
- Where permanent or intermittent stream channels cross trails, use wheel-friendly open rock culverts or properly sized buried drainage culverts to allow water to cross properly, without flowing down the trail.

Impacts to Wildlife: General Research

Trails and trail uses can also affect wildlife. Trails may degrade or fragment wildlife habitat, and can also alter the activities of nearby animals, causing avoidance behavior in some and food-related attraction behavior in others (Hellmund, 1998; Knight & Cole, 1991). While most forms of trail impact are limited to a narrow trail corridor, disturbance of wildlife can extend considerably further into natural landscapes (Kasworm & Monley, 1990; Tyser & Worley, 1992). Even very localized disturbance can harm rare or endangered species.

Different animals respond differently to the presence of trail users. Most wildlife species readily adapt or become "habituated" to consistent and non-threatening recreational activities. For example, animals may notice but not move away from humans on a frequently used trail. This is fortunate, as it can allow high quality wildlife viewing experiences for visitors and cause little or no impact to wildlife.

Other forms of habituation, however, are less desirable. Visitors who feed wildlife, intentionally or from dropped food, can contribute to the development of food-related attraction behavior that can turn wild animals and birds into beggars. In places where visitors stop to eat snacks or lunches, wildlife quickly learn to associate people with food, losing their innate fear of humans and returning frequently to beg, search for food scraps, or even raid unprotected packs containing food. Feeding wild creatures also endangers their health and well-being. For instance, after food-attracted deer in Grand Canyon National Park became sickly and dangerously aggressive, researchers found up to six pounds of plastic and foil wrappers obstructing intestinal passages of some individuals.

The opposite conduct in wildlife - avoidance behavior - can be equally problematic. Avoidance behavior is generally an innate response that is magnified by visitor behaviors perceived as threatening, such as loud sounds, off-trail travel, travel in the direction of wildlife, and sudden movements. When animals flee from disturbance by trail users, they often expend precious energy, which is particularly dangerous for them in winter months when food is scarce. When animals move away from a disturbance, they leave preferred or prime habitat and move, either permanently or temporarily, to secondary habitat that may not meet their needs for food, water, or cover. Visitors and land managers, however, are often unaware of such impacts, because animals often flee before humans are aware of the presence of wildlife.

Impacts to Wildlife: Mountain Biking-Specific Research

The impacts of mountain biking on wildlife are similar to those of hikers and other non motorized trail users.

Taylor and Knight (2003) investigated the interactions of wildlife and trail users (hikers and mountain bikers) at Antelope Island State Park in Utah. A hidden observer using an optical rangefinder recorded bison, mule deer, and pronghorn antelope response to an assistant who hiked or biked a section of trail. The observer then measured wildlife reactions, including alert distance, flight response, flight distance, distance fled, and distance from trail. Observations revealed that

70 percent of animals located within 330 feet (100 m) of a trail were likely to flee when a trail user passed, and that wildlife exhibited statistically similar responses to mountain biking and hiking. Wildlife reacted more strongly to off-trail recreationists, suggesting that visitors should stay on trails to reduce wildlife disturbance. While Taylor and Knight found no biological justification for managing mountain biking any differently than hiking, they note that bikers cover more ground in a given time period than hikers and thus can potentially disturb more wildlife per unit time.

This study also surveyed 640 hikers, mountain bikers, and horseback riders on the island to assess their perceptions of the effects of recreation on wildlife. Most respondents felt they could approach animals far closer than the flight distance suggested by the research, and 50 percent felt that recreational uses did not have a negative effect on wildlife.

Another study evaluated the behavioral responses of desert bighorn sheep to disturbance by hikers, mountain bikers, and vehicles in low- and high-use areas of Canyonlands National Park (Papouchis and others., 2001). Following observations of 1,029 bighorn sheep/human interactions, the authors reported that sheep fled 61 percent of the time from hikers, 17 percent of the time from vehicles, and 6 percent of the time from mountain bikers. The stronger reaction to hikers, particularly in the high-use area, was attributed to more off-trail hiking and direct approaches to the sheep. The researchers recommended that park officials restrict recreational uses to trails, particularly during the lambing and rut seasons, in order to minimize disturbance.

An experimental study in Switzerland evaluated the disturbance associated with hiking, jogging, and mountain biking on high elevation chamois, which are goat-like mammals found in the European mountains (Gander & Ingold 1997). The authors assessed alert distance, flight distance, and distance fled, and found that approximately 20 percent of the animals fled from trailside pastures in response to visitor intrusions. The authors found no statistically significant differences, however, between the behavioral responses of animals to the three different types of user, and authors concluded that restrictions on mountain biking above timberline would not be justified from the perspective of chamois disturbance.

A study of the Boise River in Idaho examined flushing distances of bald eagles when exposed to actual and simulated walkers, joggers, fishermen, bicyclists, and vehicles (Spahr 1990). The highest frequency of eagle flushing was associated with walkers (46 percent), followed by fishermen (34 percent), bicyclists (15 percent), joggers (13 percent), and vehicles (6 percent). However, bicyclists caused eagles to flush at the greatest distances (mean = 148 meters), followed by vehicles (107m), walkers (87m), fishermen (64m), and joggers (50m). Eagles were most likely to flush when recreationists approached slowly or stopped to observe them, and were less alarmed when bicyclists or vehicles passed quickly at constant speeds. Similar findings have been reported by other authors, who attribute the difference in flushing frequency between walkers and bikers/vehicles either to the shorter time of disturbance and/or the additional time an eagle has to "decide" to fly (Van der Zande and others. 1984).

Safety issues related to grizzly bear attacks on trail users in Banff National Park prompted Herrero and Herrero (2000) to study the Morraine Lake Highline Trail. Park staff noted that hikers were far more numerous than mountain bikers on the trail, but that the number of encounters between bikers and bears was disproportionately high. For example, three of the four human-grizzly bear encounters that occurred along the trail during 1997-98 involved mountain bikers. Previous research had shown that grizzly bears are more likely to attack when they first become aware of a human presence at distances of less than 50 meters. Herrero and Herrero concluded that mountain bikers travel faster, more quietly, and with closer attention to the tread than hikers, all attributes that limit reaction time for bears and bikers, and increases the likelihood of sub-fifty meter encounters. In addition, most of the bear-cyclist encounters took place on a fast section of trail that went through high-quality bear habitat with abundant berries. To reduce such incidents, they recommended education, seasonal closures of the trail to bikes and/or hikers, construction of an alternate trail, and regulations requiring a minimum group size for bikers.

Impacts to Wildlife: Management Implications

Many potential impacts to wildlife can be avoided by ensuring that trails avoid the most sensitive or critical wildlife habitats, including those of rare and non-rare species. There are a number of tactics for doing this:

- Route trails to avoid riparian or wetland areas, particularly in environments where they are uncommon. Consult with fish and wildlife specialists early in the trail planning phase.
- For existing trails, consider discouraging or restricting access during sensitive times/seasons (e.g., mating or birthing seasons) to protect wildlife from undue stress.

The education of trail users is also an important and potentially highly effective management option for protecting wildlife. Organizations should encourage Leave No Trace practices and teach appropriate behaviors in areas where wildlife are found:

- Store food safely and leave no crumbs behind - fed animals too often become dead animals.
- It's OK for wildlife to notice you but you are "too close" or "too loud" if an animal stops what its doing and/or moves away from you.
- It's best to view wildlife through binoculars, spotting scopes, and telephoto lenses.
- All wildlife can be dangerous - be aware of the possible presence of animals and keep your distance to ensure your

safety and theirs.

Conclusion

While land managers have long been concerned about the environmental impacts of mountain biking, there are still very few good studies published in peer-reviewed journals. White and others (2006) and Hendricks (1997) note that the majority of mountain biking research has focused on social issues, such as conflicts between trail users. As a consequence, the ecological effects of mountain biking on trails and natural resources remain poorly understood.

Still, an emerging body of knowledge on the environmental impact of mountain biking can help guide current management decisions. All of the existing scientific studies indicate that while mountain biking, like all forms of recreational activity, can result in measurable impacts to vegetation, soil, water resources, and wildlife, the environmental effects of well-managed mountain biking are minimal.

Furthermore, while the impact mechanics and forces may be different from foot traffic, mountain biking impacts are little different from hiking, the most common and traditional form of trail-based recreational activity.

Key observations about the environmental impacts of mountain biking:

1. Environmental degradation can be substantially avoided or minimized when trail users are restricted to designated formal trails. Many studies have shown that the most damage to plants and soils occur with initial traffic and that the per capita increase in further impact diminishes rapidly with increasing subsequent traffic. Many environmental impacts can be avoided and the rest are substantially minimized when traffic is restricted to a well-designed and managed trail. The best trail alignments avoid the habitats of rare flora and fauna and greatly minimize soil erosion, muddiness, and tread widening by focusing traffic on side-hill trail alignments with limited grades and frequent grade reversals. Even wildlife impacts are greatly minimized when visitors stay on trails; wildlife have a well-documented capacity to habituate to non-threatening recreational uses that occur in consistent places.
2. Trail design and management are much larger factors in environmental degradation than the type or amount of use. Many studies have demonstrated that poorly designed or located trails are the biggest cause of trail impacts. As evidence, consider that use factors (type, amount, and behavior of trail visitors) are generally the same along the length of any given trail, yet there is often substantial variation in tread erosion, width, and muddiness. These impacts are primarily attributable to differences in grade and slope alignment angle, soil type and soil moisture, and type of tread construction, surfacing, and drainage. This suggests that a sustainable trail that is properly designed, constructed, and maintained can support lower-impact uses such as hiking and mountain biking with minimal maintenance or degradation.
3. The environmental degradation caused by mountain biking is generally equivalent or less than that caused by hiking, and both are substantially less impacting than horse or motorized activities. In the small number of studies that included direct comparisons of the environmental effects of different recreational activities, mountain biking was found to have an impact that is less than or comparable to hiking. For example, Marion and Olive (2006) reported less soil loss on mountain bike trails than on hiking trails, which in turn exhibited substantially less soil loss than did horse and ATV trails. Similarly, two wildlife studies reported no difference in wildlife disturbance between hikers and mountain bikers (Taylor & Knight 2003, Gander & Ingold 1997), while two other studies found that mountain bikers caused less disturbance (Papouchis and others. 2001, Spahr 1990). Wilson and Seney (1994) found that horses made significantly more sediment available for erosion than hikers or mountain bikers, which were statistically similar to the undisturbed control. One final point to consider, however, is that mountain bikers, like horse and vehicle users, travel further than hikers due to their higher speed of travel. This means that their use on a per-unit time basis can affect more miles of trail or wildlife than hikers. However, an evaluation of aggregate impact would need to consider the total number of trail users, and hikers are far more numerous than mountain bikers.

Mountain Bike Management Implications

So what does this mean for mountain biking? The existing body of research does not support the prohibition or restriction of mountain biking from a resource or environmental protection perspective. Existing impacts, which may be in evidence on many trails used by mountain bikers, are likely associated for the most part with poor trail designs or insufficient maintenance.

Managers should look first to correcting design-related deficiencies before considering restrictions on low-impact users. By enlisting the aid of all trail users through permanent volunteer trail maintenance efforts, they can improve trail conditions and allow for sustainable recreation.

Dr. Jeff Marion is a scientist with the U.S. Geological Survey who studies visitor impacts and management in protected natural areas. Jeremy Wimpey is a doctoral candidate in the Park and Recreation Resource Management program at Virginia Tech. Contact them at Virginia Tech, Forestry (0324), Blacksburg, VA 24060, jmarion@vt.edu (mailto:jmarion@vt.edu) , wimpeyjf@vt.edu (mailto:wimpeyjf@vt.edu) .

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San Diego Mountain Biking Association

November 30, 2010

Environmental Coordinator Trails PEIR
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ceqansc@parks.ca.gov

Thank you for considering our comments during the scoping period for the State Parks Roads and Trails Change-in-Use Program environmental impact report (PEIR). One of our members, Russ Boggs, attended the scoping meeting in Perris in November.

Our understanding is that the California State Parks (CSP) is using this PEIR to develop an overall framework and consistent approach to changing the use designation on roads and trails. We applaud the CSP for undertaking this project. California's population continues to increase, and the CSP system needs to keep pace with providing its increased number of residents with "opportunities for high-quality outdoor recreation" as stated in CSP's mission statement (CSP website: "Our Mission" www.parks.ca.gov/?page_id=91; accessed on November 27, 2010).

Additionally, it appears that the users of California SP are increasing in their diversity; this increased diversity includes how they choose to enjoy their time outdoors. Thirty years ago, virtually the only non-motorized travelers on state park trails were hikers, runners and horseback riders. Today, a relatively new group of users, mountain bikers, have come to enjoy the backcountry regions of state parks. Unfortunately, they are excluded from large numbers of trails. For one thing, mountain bikers are permanently excluded from regions of state parks that are also designated as wilderness areas, (e.g., Rancho Cuyamaca State Park). There are other trails, however, within state parks that could be used by bicyclists if the use designation was changed. At the same time, as far as we know, there are few or no trails within the CSP system where MTBs have exclusive rights of access or are even favored.

Given that the population of California will continue to increase, increased numbers of residents will result in increased use of trails. It's important to expose our diverse California population to the variety of landscapes of the CSP system.

In evaluating the environmental impact of additional trail users, or the environmental impact of a allowing a different class of trail users, the study should focus, at least in part, on the per capita impact. For example, would an individual mountain biker have a greater impact on the trail/environment than an individual hiker? Some studies have found that a hiker or a bicyclist have an equivalent impact on soil erosion, and both have less impact than a horse (see attachments).

Additionally, some consideration should be given to the potential that if a trail is opened to mountain bikes, the usage of other trails used by mountain bikes within the same state park may decrease, and therefore, if indeed there is actually any environmental effect to opening a trail to a new class of users, such an opening may self-mitigate. As an example, if a second trail is opened at the farthest reach of the popular loop, that might decrease use of a first trail.

As much as possible, environmental analysis should take advantage of, and be based on, research publications in the field. For example, some studies suggest mountain bicyclists are less disruptive to wildlife possibly because they are less likely to stop and examine individual animals (i.e., staring and pointing). Also, mountain bicyclists are more likely to stay on the trail than other users, therefore confining the physical environmental impact to just the trail itself.

We have included with this letter a few PDFs (with URLs included) taken from the International Mountain Bicycling Association's (IMBA) website (under resources) representing analysis of recent publications concerning the impact of recreational use on park-like areas. Citations to the actual research papers are contained within PDFs. We would be happy to help you obtain copies of the original papers if it would help you.

In conclusion, it is important to allow use of the CSP system by a diverse group of users. Currently we have a perception that certain user groups are favored in terms of trail use within the CSP system, especially when the wilderness areas are included. Access to the trail system within the CSP should be adjusted to provide equal access to the trail system of all users regardless of their chosen means of recreation.

Links:
http://www.imba.com/resources/research/environmental-impacts
http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices

Our contacts for questions or comments are:
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Sincerely,

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AN AFFILIATE OF IMBA
INTERNATIONAL MOUNTAIN BICYCLING ASSOCIATION

Wendell & Inez Robie Foundation (WIRF)

December 12, 2010

Environmental Coordinator---Trail PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

Re: Comments in opposition to PEIR

TO WHOM IT MAY CONCERN:

Most of California's park trails are narrow and were designed for foot traffic consisting primarily of individuals walking single file or riding a horse which has been the case for over 150 years. The fundamental flaw with the PEIR proposal is its underlying premise: that changing trail use from foot traffic only to foot and vehicle traffic combined can be safely accommodated on most existing trails. Our foundation has worked with the California Parks in several pilot programs with the same outcome each time; the mountain bikers come to dominate the area with the experience for the hikers and equestrians being diminished. The trails were never designed for wheeled use of any kind. They were designed as the equivalent of sidewalks in the forest. We have known for years that wheeled vehicles and foot traffic do not safely mix and it is the foot traffic that must give way or be injured. That is why under the vehicle code bicycles cannot be ridden on pedestrian walkways.

With trails as mentioned above, the experience is that once mountain biking becomes a predominant use on a trail the other users are driven off for safety reasons. We believe the bike use should be considered in the original planning of a trail. The simple fact that a trail exists does not mean a mountain bike should be permitted to ride upon it.

Both motorized and non-motorized trail riding has become increasingly popular on dirt roads along with trails. It is generally recognized that the noise, speed, and air pollution associated with motorized recreation during both summer and winter is incompatible with foot traffic users on single track trails. For this reason the State OHV program was created to provide appropriate areas for motorized vehicle use.

For decades the WIRF has noted there is no enforceable way of managing the large volume of new users on single track trails. This has been a major problem in every local, state, and national park where bikes are invited to use unpaved single track trails.

In theory environmental damage can be mitigated. However, what cannot be eliminated or mitigated are the horrendous significant safety issues inherent in allowing mountain biking on narrow hiking and riding trails. As noted single track trails were not designed for this use nor for the speed associated with wheeled vehicle use as opposed to walking, hiking and horse back riding. The existing trails are narrow and often have blind corners as they ascend and descend steep terrain. Also precipitous drop-offs are common along these single track trails. The average mountain bike speed is 15-18 miles an hour on level ground along with specially designed mountain bikes which can travel at speeds in excess of 25+ miles an hour. These speeds are incompatible with the much slower pace of hikers which include families, children, elderly and disabled persons. The horseback coummunity is at an especially great risk while riding along these single track trails which have drop-offs along with blind corners.

Mountain bikes can be accommodated where there exists a well designed trail which is at least 72 inches wide and possesses good lines of sight. This design would allow room for multiple users on the same trail. No trail less than six feet in width should be eligible for a change in use designation to add wheeled vehicles under the PEIR program, unless the trail is going to be widened with safety issues like blind corners and drop-offs addressed.

The WIRF has funded over 1,000,000 dollars in trail maintenance for repairs, reroutes, and construction of public hiking and equestrian trails. We know these trails to be inappropriate for mountain bikes because we built them.

It is important to note that the "Draft Trail Use Change Process (PEIR Revision)" flow chart supposes the availability of a critical potential mitigation alternative. This alternative "enforcement and patrol..." to reduce user conflicts is wishful thinking. Enforcement simply does not exist now and none is expected in the future due to continued lack of funding. The lack of funding has caused fewer and fewer rangers in California to cover larger and larger territories. No one disputes that enforcement of trail user conflicts is beyond the resource capababilities of park rangers. Education efforts can be helpful with trail users but are totally ineffective with a significant percentage of the mountain biking community. Signs prohibiting bikes are many times defaced, removed or ignored. To date policing single track trails through education alone has not worked.

In conclusion the PEIR process was designed for the state to assess the environmental impact of allowing mountain bikes on wide trails along with other users. Minimum requirements for well designed trails should be a least a 72 inch width, good visibility and no blind corners to accommodate room for all users. If minimum standards are not required most of the state's single track hiking and equestrian system will be converted to wheeled vehicle use with little or no consideration for the safety and enjoyment of other users. The opening up of existing single track trails to wheeled vehicles would be a tragic loss for the hikers and horse back riders especially since these trails were designed and built to serve this recreation population.

Sincerely,

Jim Larimer, Executive Director (WIRF) Wendell & Inez Robie Foundation
PO Box 714 Foresthill, CA 95631 (530) 367-4332 robiepk@robiefoundation.org

MARIN CONSERVATION LEAGUE 75

November 30, 2010

Environmental Coordinator – Trails PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

Subject: Statewide Program Environmental Impact Report for Roads and Trails Change- In-Use (PEIR)

Dear Sir or Madam,

The California Department of Parks and recreation ("State Parks"; "Department") announced in April 2010 that it intended to prepare a draft Statewide Program Environmental Impact Report to address the broad environmental effects that may be associated with existing trail/road change-in-use procedures. Changes in use can include adding and removing official recreational uses on roads and trails in State Park units, such as changing existing roads or trails from hiking use to multi-use to include mountain bikers and equestrians, or converting multi-use trails to single use. Changes might also be accompanied by trail management programs to separate different user groups from concurrent use of a trail.

Two public scoping sessions were held to explain the process to be followed for this PEIR and solicit written comments. The purpose of Marin Conservation League's letter is two-fold: 1) to review our understanding of how the PEIR process relates to State Parks' "existing trail/road change-in-use procedures" and request clarification in the PEIR; and 2) to provide comments to be considered in developing the scope of analysis for the subject PEIR.

1. Relationship of PEIR to Existing Change-in-use Procedures

State Parks has existing procedures for evaluating trail use change requests originating from either user groups or trail system planners within the Department. In the past the Department has filed categorical exemptions from CEQA compliance on the premise that changes-in-use may be minor, such as in "minor alteration of land," and/or because procedures employed by the Department are "CEQA-equivalent," that is, they identify environmental conditions and incorporate best management practices into design, thereby obviating the need for further CEQA review. This was the approach taken by the Department in 2009 when it filed a Notice of Exemption for the conversion of the single-track Bill's Trail in Samuel P. Taylor State Park to allow use by mountain bikes. At least two elements important to CEQA review are missing in this approach – first, a comprehensive review of environmental impact topics, as found in the Initial Study Checklist and/or an EIR; and second, the opportunity for public comment, which is an essential feature of the CEQA process. We assume that this PEIR is being prepared to correct these deficiencies.

415.485.6257
415.485.6259
mcl@marinconservationleague.org
www.marinconservationleague.org
1623-A Fifth Avenue
San Rafael, CA 94901

The purpose of the Program EIR is to cover the full range of environmental effects that may result from proposed trail/road changes-in-use at a general ("programmatic") level. The PEIR thus will serve as a "first-tier document" as specific projects are proposed and evaluated. Program EIRs are supported and encouraged by the CEQA Guidelines where "a series of actions are related in connection with . . . plans or other general criteria to govern the conduct of a continuing program"; or "as individual activities . . . having generally similar effects which can be mitigated in similar ways." (Excerpts from CEQA Guidelines 15168) The Parks Department will be able to "avoid duplicative reconsideration of basic policy considerations and to reduce paper work." The PEIR will also support State Parks' CEQA compliance as specific changes-in-use are proposed.

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User Impacts. Much has been said about the impacts of various user groups on trails, some of it based on research, but much of it on personal observation and anecdotal evidence. All user groups – walkers, joggers, equestrians, and mountain bikes cause impacts such as the following, in varying degree:

- vegetation trampling and compaction of leaf litter and soil;

- soil loss through rutting and erosion, with consequent sedimentation of waterways;
- loss of both herbaceous and brittle woody plant species near trails;
- habitat disturbance and trail "widening" due to wandering off trail or cutting corners;
- habitat fragmentation (widening trail impedes movement and dispersal of animals that are reluctant to cross exposed openings);
- habitat disturbance from noise and the presence and motion of users (e.g., decreased nesting near trails, altered bird species composition near trails, and increased predation of nests by animals using the trail as corridor);
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- nutrient enrichment from horse manure and urine that could favor invasion of weedy species along horse trails; and
- direct loss of small or slow-moving wildlife such as small rodents and reptiles by rapid moving bicycles ("road kill").

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<u>Determining Significance Thresholds.</u> Since the significance of impacts will vary from project to project depending upon their location, the existence of sensitive habitats and species, the degree of modification necessary to accommodate a new use, and other factors, a single standard for significance for all projects is totally inappropriate. How will thresholds of significance be determined? The PEIR should contain a list of such thresholds or indicate other sources of thresholds, such as Appendix G of the CEQA Guidelines.

<u>Mitigation Measures.</u> State Parks currently follows a manual of Best Management Practices to guide trail design. This is a comprehensive document, tested over time under many different conditions, but its focus is on the physical sustainability of trails rather than protection of habitats or aesthetics. We request that the PEIR either append a list of BMPs to the main document or otherwise incorporate them as specific "mitigation measures." Other measures should be included to mitigate potential impacts such as those summarized above. The PEIR is a public document, not just a form of legal compliance, and as such, it should provide the reader with as complete a picture as possible of the general implications of road or trail change-in-use and the approaches used by the Department to minimize impacts and preserve the quality of the trail experience for all users.

<u>Other Issues.</u> The Marin Conservation League is particularly concerned over how potential conflicts between various user groups, and the associated safety issues, will be addressed in the PEIR and applied to subsequent specific projects. We are pleased that the PEIR will address this issue in its section on Recreation Use. This impact is a major concern for proposed multi-use trails, particularly those that were originally designed as single-track trails. Road and trail management in State Parks – and specific change-in-use projects – must ensure that potential user conflicts are fully mitigated and that no road or trail be allowed to function unsafely. The PEIR should spell out the road and trail performance standards that are necessary to achieve this objective. Specific change-of-use projects should be designed to meet those standards. The PEIR should establish criteria for when a trail is inappropriate for conversion to multi-use –e.g., is too steep or narrow and winding – to be considered for shared use. The PEIR should provide guidance to District and Sector offices of the State Park system on how to assess the potential for conflict and design for safety on specific project proposals. Other techniques besides "safe" physical design should be discussed in the PEIR, such as trail management to separate user groups, signage, and strict enforcement of trail rules and regulations.

We appreciate the opportunity to provide these scoping comments for the PEIR and look forward to participating in the public review of the draft PEIR in 2011.

Sincerely yours,

Nona Dennis

Nona Dennis, President

Cc: Senator Mark Leno
Assembly Member Jared Huffman

Amber Giffin

From: CEQA NSC
Sent: Tuesday, September 07, 2010 11:05 AM
To: West, Heidi
Subject: MVandeman_Roads and Trails Change-in-Use (PEIR)_8-25-10

From: Mike Vandeman [mjvande@pacbell.net]
Sent: Wednesday, August 25, 2010 2:51 PM
To: CEQA NSC
Subject: Statewide Program Environmental Impact Report for Roads and Trails Change-in-Use (PEIR)

Bicycles should not be allowed in any natural area. They are inanimate objects and have no rights. There is also no right to mountain bike. That was settled in federal court in 1994: http://home.pacbell.net/mjvande/mtb10 . It's dishonest of mountain bikers to say that they don't have access to trails closed to bikes.
They have EXACTLY the same access as everyone else -- ON FOOT! Why isn't that good enough for mountain bikers? They are all capable of walking....

A favorite myth of mountain bikers is that mountain biking is no more harmful to wildlife, people, and the environment than hiking, and that science supports that view. Of course, it's not true. To settle the matter once and for all, I read all of the research they cited, and wrote a review of the research on mountain biking impacts (see http://home.pacbell.net/mjvande/scb7). I found that of the seven studies they cited, (1) all were written by mountain bikers, and (2) in every case, the authors misinterpreted their own data, in order to come to the conclusion that they favored. They also studiously avoided mentioning another scientific study (Wisdom et al) which did not favor mountain biking, and came to the opposite conclusions.

Those were all experimental studies. Two other studies (by White et al and by Jeff Marion) used a survey design, which is inherently incapable of answering that question (comparing hiking with mountain biking). I only mention them because mountain bikers often cite them, but scientifically, they are worthless.

Mountain biking accelerates erosion, creates V-shaped ruts, kills small animals and plants on and next to the trail, drives wildlife and other trail users out of the area, and (worst of all) teaches kids that the rough treatment of nature is okay (it's NOT!). What's good about THAT?

For more information: http://home.pacbell.net/mjvande/mtbfaq .

--

I am working on creating wildlife habitat that is off-limits to humans ("pure habitat"). Want to help? (I spent the previous 8 years fighting auto dependence and road construction.)

Please don't put a cell phone next to any part of your body that you are fond of!

http://home.pacbell.net/mjvande

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHAINGE-IN-USE PROGRAM

Name: LARRY MINIKES
Mailing Address: 230 COLEMAN DR SAN RAFAEL 94901
Email Address: LMINIKES@AVSTIM.COM

Comments: RE: WILDLIFE IMPACTS

FOR SEVERAL YEARS WE HAVE DOCUMENTED THE DEATH OF MANY SMALL CREATURES THAT ARE BEING RUN OVER BY MOUNTAIN BIKES. THESE INCLUDE SMALL VOLES, FENCE LIZARDS, AND VARIOUS OTHER LIZARDS, SNAKES, AND IN PARTICULAR SLOW MOVING CALIFORNIA NEWTS THAT TEND TO MIGRATE ACROSS TRAILS AND FIRE ROADS DURING THE WET SEASON. TO OUR KNOWLEDGE, NO ONE HAS STUDIED THE CUMULATIVE IMPACTS. HIKERS AND EQUESTRIANS RARELY STEP ON A CREATURE BUT IT IS NOT UNUSUAL TO RIDE ON MT. TAM, FOR EXAMPLE, AND SEE A RUN OVER CREATURE OR TWO ON EVERY RIDE. (I AM A MOUNTAIN BIKER). THE QUESTION WITH CHANGE OF USE IS HOW DO YOU MITIGATE FOR THIS? AND IS THERE A SIGNIFICANT CUMULATIVE IMPACT? I CAN SUPPLY SEVERAL PHOTOS, AT REQUEST, DOCUMENTING THIS.

Meeting Date: 9.25.10

You may also submit comments by email to ceqansc@parks.ca.gov no later than October 11, 2010 (Subject Line: Change in Use).

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHAIGE-IN-USE PROGRAM

Name Connie Berto
Mailing Address
Email Address cberto3@sonic.net

Comments Recreation and Land Use

The presence of speeding mt. bikes on footpaths has virtually killed off horse or hiker use at China Camp S.P. Elderly people especially, no longer use that park because they are afraid. Stop this!!

Mt. bike impacts are becoming very well documented nation-wide. California S.P. needs to wake up to the safety hazards and damage caused by mt. bikes.

We can, and are, sharing the vehicular-width dirt roads (fire roads) with mt. bikes. Good sight lines, good surface, room to move aside. — Why change this?

Change, to allow bikes on footpaths, is wrong. Keep what works!

Meeting Date 25 Sept 2010

You may also submit comments by email to ceqansc@parks.ca.gov no later than October 11, 2010 (Subject Line: Change in Use).

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHAINGE-IN-USE PROGRAM

Name Connie Berto

Mailing Address

Email Address CBERTO3 @ sonic.net

Comments Geophysical Resources

Marin has traditionally had some major salmon & steelhead runs. Its spawning sites are fiercely protected. Changing trail use - for instance, to allow mt. bikes on Bill's Trail in Taylor Park - would open up a spawning stream to sedimentation.

Bill's Trail is downhill all the way, with blind corners, and should never have mt. bikes on it

The effects on the Pacific Coast Migratory Flyway should be carefully worked out.

Meeting Date 25 Sept 2010

You may also submit comments by email to ceqansc@parks.ca.gov no later than October 11, 2010 (Subject Line: Change in Use).

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHAINGE-IN-USE PROGRAM

Name Connie Berto
Mailing Address
Email Address CBERTO3@sonic.net

Comments Biological impacts:
Night riding by mt. bicyclists has already had detrimental effects on wildlife. Many species bunk down during the day and do all their activities at night. The bright halogen lights of mt. bikes, and the presence of humans, are disruptive and harmful, even possibly lethal, to wildlife if allowed uses were to be changed.
There needs to be night-time restrictions.
The choice of "no change in use" should be a consideration.
Many trails are best left just as they are (with upkeep, as needed)

Meeting Date 25 Sept - 2010

You may also submit comments by email to ceqansc@parks.ca.gov no later than October 11, 2010 (Subject Line: Change in Use).

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHAIGNE-IN-USE PROGRAM

Name: CAROL COLBERT

Mailing Address: 196 ESMEYER DRIVE, San Rafael, CA 94903

Email Address: CC76COLBERT@gmail.com

Comments: RE: DRAFT TRAIL USE CHANGE PROCESS— obtaining input from local trail users, neighbors ~~[illegible]~~ and environmental groups should be considered By recommendations for trail use change are made by an evaluation team— Safety ē enjoyment of all users ē interested parties is as much an issue as engineering feasibility decisions— this input should be sought after a trail use survey is completed so comments can be made ē heard By a recommendation

Meeting Date: 9/27/10

You may also submit comments by email to cegansc@parks.ca.gov no later than October 11, 2010 (Subject Line: Change in Use).

From: CEQA NSC
Sent: Thursday, December 02, 2010 10:28 AM
To: West, Heidi
Subject: DPutz for NDennis_MCL_11-30-10

Attachments: PEIR Change in Use scope letter_11.23.2010.doc
FYI

From: Delos Putz [marincwby@comcast.net]
Sent: Tuesday, November 30, 2010 5:29 PM
To: CEQA NSC
Cc: Nona Dennis; Roger Roberts
Subject: Trails PEIR

I am a hiker and horseback rider residing in San Geronimo in the western portion of Marin County. I wish to join in the excellent comments on your Statewide Program Environmental Impact Report for Roads and Trails Change-In-Use (PEIR) submitted on behalf of the Marin Conservation League (MCL) by its President, Nona Dennis. A copy of the MCL comments are attached to this email.

In particular, I wish to join in the following concerns expressed by MCL:

1. Ensuring Advance Notice of Changes Being Considered. How will the public be given adequate notice that a specific change-in-use is being considered, and how will the public be given an adequate opportunity to comment on any specific changes before they are approved? At minimum, organizations and individuals should be able to register with State Parks to receive electronic notice of proposed changes-in-use in their area.

2. Adoption of Specific Standards for determining the Suitability for Use by Specific groups and for Multi-Use. Criteria should be established for determining when a trail is suitable for use by specific groups and for multi-use. Such criteria would include trail width, grade, sight lines and steepness of adjacent terrain.

3. User Conflicts and Threats to the Safety of Users . The PEIR should make clear that the potential for user conflicts and safety are site specific and must be addressed for each proposed change-of-use. The PEIR should make clear that a hiker/horse trail cannot be changed to "multi-use" if any portion of the trail is unsafe for multi-use, unless and until any unsafe portions have been made safe.

4. The Impact of Changes of Use on User Experience Should be Addressed in the PEIR. Moreover, it should be recognized that the significance of these impacts are very much site specific and must be considered separately as to each individual project.

C. Delos Putz
San Geronimo, CA
Tel: (415) 488-4123

November 30, 2010

Environmental Coordinator – Trails PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

ceqansc@parks.ca.gov
(Subject Line: 'Trails PEIR')

Subject: Statewide Program Environmental Impact Report for Roads and Trails Change- In- Use (PEIR)

Dear Sirs,

The California Department of Parks and recreation ("State Parks"; "Department") announced in April 2010 that it intended to prepare a draft Statewide Program Environmental Impact Report to address the broad environmental effects that may be associated with existing trail/road change-in-use procedures. Changes in use can include adding and removing official recreational uses on roads and trails in State Park units, such as changing existing roads or trails from hiking use to multi-use to include mountain bikes and equestrians, or converting multi-use trails to single use. Changes might also be accompanied by trail management programs to separate different user groups from concurrent use of a trail.

Two public scoping sessions were held to explain the process to be followed for this PEIR and solicit written comments. The purpose of Marin Conservation League's letter is two-fold: 1) to review our understanding of how the PEIR process relates to State Parks' "existing trail/road change-in-use procedures" and request clarification in the PEIR; and 2) to provide comments to be considered in developing the scope of analysis for the subject PEIR.

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We appreciate the opportunity to provide these scoping comments for the PEIR and look forward to participating in the public review of the draft PEIR in 2011.

Sincerely yours,

Nona Dennis, President

Cc: Senator Mark Leno
Assembly Member Jared Huffman

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHANGE-IN-USE PROGRAM

1 of 8 people at this mtg!

NOV. 13, 2010

Name Emily GABEL

Mailing Address

Email Address egluddy@aol.com

Comments

o use as a baseline the degree to which a trail user can penetrate a park system within an average period of time, like 3hrs, (1½ in 1½ out) depending on use segways, hikers, bikers, horse riders, trail runners. Note - equestrians tend to walk trails & there is probably good data on average speeds

o draw a distinction between urban and remote parks

Meeting Date

o Also env. benefit of wide trails, once built, not single track

You may also submit comments by email to ceqansc@parks.ca.gov no later than November 30 , 2010 (Subject Line: Change in Use).

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHANGE-IN-USE PROGRAM

Name: JIM HASENAUER

Mailing Address: 4359 PAMPAS ROAD, WOODLAND HILLS, CA 91364

Email Address: imbajim@aol.com

Comments: I will submit further written comments. As an overview to change of use, I want parks to provide mtb community the same range and extent of opportunities it offers other trail users. Three significant values should guide the Change of Use process: 1) Equity - trail mileage ~~and diversity of experience (except that~~ MTBiker should have access proportionate to their numbers.

Over

Meeting Date: 11/13/2010

You may also submit comments by email to ceqansc@parks.ca.gov no later than November 30 , 2010 (Subject Line: Change in Use).

2.) Diversity of trail experience. Bikers like all users differ in their skills and recreational preferences. MTB opportunities should not be limited to flat, smooth, easy, obstacle free trails. We need those, but we want "at your own risk" access to a range of opportunities.

3.) Connectivity. Its important for riders to have access and connectivity to important features, sites, adjacent trail systems, etc. High priority change of use should be providing this kind of connectivity.

Heidi West, Environmental Coordinator
California State Parks
Northern Service Center
One Capitol Mall, Suite 410
Sacramento, CA 95814

We need trail justice. A legitimate group of park visitors is being denied access to many park facilitiese because other users are uncomfortable with us. That's not fair!

COMMENT CARD

CALIFORNIA STATE PARKS
ROAD AND TRAIL CHANGE-IN-USE PROGRAM

Name George Hague

Mailing Address 26711 Ironwood Ave

Email Address gbhague.@gmail.com

Please notify me of all documents and meetings related to this project.

Comments ① What level of mechanized equipment will be allowed to "improve" trails. The least impact must be the standard, Not the cheapest or easiest. ② Just like General Plans this needs one needs to be updated every 8-10 years - will this happen. ③ As a result of global warming you must be aware of the need for Resilient Habitat, How will you factor this into the EIR. ④ Your Cumulative impacts must be Species by Species. Your biological studies must be at the correct time of year for each species. ⑤ You need to publize these meetings much better which includes local newspapers. ⑥ How will you accomplish question "4" in the Document for the Public to read?

Meeting Date NOV 13 Meeting

You may also submit comments by email to ceqansc@parks.ca.gov no later than November 30 , 2010 (Subject Line: Change in Use).

November 29, 2010 By email ceqans@parks.ca.gov

Environmental Coordinator – Trails PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

Dear Environmental Coordinator,

RE: Trails PEIR

Having attended the public scoping meeting at Lake Perris and reviewed the material for the Change-in-Use Survey and the process chart related thereto, I have the following comments for the Program EIR.

The Change of Use Survey, as written, appears to convey benefits to users who wish to add a new use on trails. As part of any analysis of Alternatives in the PEIR, State Parks and the environmental consultant should prepare three distinct Change- in-Use Survey forms:

1. "No Change-in-Use" to recognize that multiple users, such as hikers and horseback riders, have the clear option to request that Parks maintain an existing trail under its current use status. Environmental benefits accrue to maintenance of compatible natural trail uses including resource protection and public safety.
2. "Change-in-Use for Reduction" to recognize that the consequential loss of resource protection and visitor public safety, are distinct environmental effects which can be remedied by putting a trail on a use diet.
3. "Change-in-Use for Addition" is the current structure of the Change in Use Survey. It allows the request (then puts the Agency on the defensive for not acceding to the request in the face of well organized partisan campaigns pushing for the change).

Given scarce Park resources, likely absence of any meaningful enforcement and the amount of public resources already spent to develop trail modification techniques to reduce the speed of mountain bike use on multi use trails, it is critical to have all three options available as a balanced approach (for example, my reading of the current survey does not consider trails which intercept the trail in question, something that leads to expansion of unpermitted uses into the matrix of the trail system).

With respect to adding mountain bike use, the following unique use impacts should be assessed:

1. Trail tread widening (a practice that may enhance rides, but increases damage and habitat fragmentation).
2. Riding up the up-hill slope to reduce or "shave" bike use speed that results in increases environmental damage to the slope. Armoring the slope makes clear that secondary impacts follow from this practice.
3. Greater penetration into natural habitat and resources of State Parks (SP).

4. Speed differential as compared to other uses. This factor has been repeatedly reported by the public and members of the California Trails Committee as reflected in their publicly available meeting minutes. It is a key safety and resource impact.

   Speed also can cause environmental damage because bicycle uses/users often occupy the center of the trail , travel in groups and have difficulty staying on the trail tread when the trail steepness causes high speeds (see #1 and #2 above).

5. Single accident users. Rescue and medical costs should be examined. The public likely bears the cost of the consequences of mountain bike use accidents even though they may be predominantly single user accidents. This should be assessed.
6. Secondary and cumulative impacts from more parking space demand at trail heads to accommodate added uses.

No provision is evident that requires a "before" and "after" assessment. Had this been done on the Tapia Spur trail in Malibu, for example, it would have demonstrated displacement and serious safety issues to other uses arising from added mountain bike use.

In discussing user conflicts, the argument that official reports or scientific data are required to establish the existence of user conflict must be set aside. The environmental preparer should not ignore the written decision of Ninth Circuit Court of Appeals which held, in its finding in favor of the Defendant Babbitt, that:

> Individual comment is a very persuasive indicator of "user conflict," for determining the existence of conflicts between humans cannot be numerically calculated or counted; rather, the existence of conflict must be evaluated. *The court can envision no better way to determine the existence of actual past or likely future conflict between two user groups than to hear from members of those groups.* (Bicycle Trails Council of Marin v. Babbitt, 82F. 3d 1445, Court of Appeals, 9th Circuit, 1996) Emphasis added

The Court of Appeals accepted user experience as an indicator of conflict. State Parks is well positioned to follow the Court's opinion.

In closing, the public use of trails should not compromise the nature and character of state park areas; the goal of visitor safety is legitimate. Public safety, resource protection and the avoidance of conflicts are equally legitimate outcomes.

Sincerely,

ORIGINAL SIGNED BY EMILY GABEL

Emily Gabel
440 West Elm Avenue
Burbank, CA 91506

Road and Trail Change in Use

To: Heidi West

In regard to the road and trail change in use plan placed on the table for a solution to our continued two to three decade public conflict and lack of funding or trail maintenance is not the solution. Right up front our choices for solutic ns have to come to the reality that California is bankrupt. Federal Energy Regulatory Commission statec, "The order concluded that conversion of any existing project trails to shared use for the remaining license term is not warranted. To the contrary, maintaining trails within the project for use only by equestrian and hikers offers a unique recreatic nal experience worthy of preservation. In addition, shared use of trails increases saf ety concerns and users conflicts, and necessitates additional trail maintenance and mo lifications measures." We do not now, and will not in the foreseeable future ha e public budgets to pay for trail maintenance, let alone the modifications that will be rec uired for the change of use. The same applies for public funding to provide adequ ate Ranger patrol for the enforcement of these public recreational trails.

We need to do reality-based budgeting that promotes public involvem ent, fiances, and privatization. We need to look at new solutions to maintain and enhai ice our recreational trail systems. These solutions should enlist a creative ins piration to engender the general public to be volunteers and stewards of our rec eational trails. We need to look at solutions that promote a diverse recreational comi nunity that can safely seek the enjoyment of our recreational trails. Consideration of developing separate trails for limited use of mountain bikes and hikers. And sepai ate trail for limitec use of equestrians and hikers. This gives each recreational trail indivi dual the incentive and the reason to be a steward of our recreational trails, and insures our diverse recreational community.

There has been and continues to be a need for avenues to be develo ed to provide separate mountain bike trails and technical parks. Built to their specif cations for their trail recreation and stewardship. Promoting these opportunities by rec ucing the time lines for CEQA and NEPA would be a great incentive.

To view "one size fits all" does not fit our recreational trails environmei tally or our diverse recreationalists.

Thank you for your time and consideration,

Donna Williams
Address: 4170 Auburn Folsom Road,
Loomis, California, 95650
Phone: (916) 837-8880
Email: dmwynot@gmail.com

December 8, 2010

Environmental Coordinator – trails PEIR
1 Capitol Mall, Suite 410
Sacramento, CA 95814

Dear Coordinator,

Changing single-use trails to multi-use puts all trail users at real risk. In a perfect world, hikers, bikers and equestrians would have unlimited access to all trails. Realistically, despite the good intentions of most trail users, mountain bikes and horses are an extremely dangerous mix. Allowing them to use the same trails will inevitably result in serious, possibly fatal, accidents.

We enjoy both mountain biking and horseback riding. They simply do not belong on the same trails. We are convinced, and are willing to accept, that limits on where we ride our bikes and our horses are critical to our safety and that of all others. Mountain bikes are relatively swift and silent. Horses, no matter how well trained and experienced, are prey animals whose instinct when startled is to bolt, flee and sort things out later. Placing bikes and horses together, especially on narrow, winding, single-track trails with limited visibility, sharp canyon drop-offs on one side and steep, wooded hills on the other is a recipe for disaster. The danger exists for horse, rider and biker and it is naïve and ignorant to believe it isn't real.

The answer is not to alternate days that bikes and horses are allowed to use trails. While many, probably most, mountain bikers we have encountered on trails, both multi-use and those limited to horses and hikers, are considerate and knowledgeable about trail etiquette, a significant number are not. They ride on trails where they're clearly not allowed. When confronted, they claim to be lost. They ride fast downhill, where stopping in a timely manner is not always possible. They seem unconcerned about the possibility of meeting horses and how those animals will react. They cannot be trusted to respect an alternate day policy and there is no viable means of enforcement.

In order to protect all trail users, bikers and equestrians must accept limitations on their access to trails. It is, after all, not such a sacrifice if it prevents life threatening encounters.

Sincerely,

Janice Myers Chris Myers

Janice and Christopher Myers
5620 Reservoir Ct.
Georgetown, CA 95634

December 22, 2010

Environmental Coordinator – Trails PEIR
Via email
To: ceqansc@parks.ca.gov

Thank you for this opportunity to submit comments on scoping for the *Roads and Trails Change In Use Programmatic Environmental Impact Report*. My name is Cathy Haagen-Smit. I am a mountain biker, hiker and trails advocate who has hiked, ridden and volunteered on trails for over 20 years. I co-founded the local nonprofit, the Folsom Auburn Trails Riders Action Coalition [FATRAC] which has dedicated 1000s of hours on trails such as the popular Foresthill Divide Loop Trail in the Auburn State Recreation Area and the Granite Bay Trail in the Folsom Lake SRA. FATRAC has been instrumental in bringing to the region experts on trail design, maintenance and management from the Subaru Trail Care Crew program of the International Mountain Bicycling Association [IMBA]. I am on the board of the California Trails & Greenways Foundation, reviewing small grant applications for a variety of multiple use trail projects that demonstrate good trail stewardship and collaboration. In attending the California Trails & Greenways Conference for the past 15 years, I have helped present Trails Sharing workshops and participated on a panel discussing conflict resolution. I am a member of the California Recreational Trails Committee, but am submitting this letter as an individual, not representing the CRTC. I am submitting the following comments as an individual with a long history of trail use, advocacy and stewardship. Thank you for considering them as part of scoping.

First, I would like to express support for this Programmatic EIR process. It recognizes a true need for a new way of getting things done on the ground at various park units in a standardized way and balances public input with staff expertise.

EXECUTIVE SUMMARY AND INTRODUCTION.
Adequately describing the purpose and goals in the *Executive Summary* and *Introduction* will help the public and staff understand the document**.** People who read/use the PEIR may accept this process if they are educated early in the document about why this is a relevant process. Explain why the CEQA's provision for using a Programmatic EIR fits; that first tier EIRs are supported by CEQA guidelines where a series of actions maybe related to each other either geographically or *as parts of a continuing program*. It also acknowledges that site-specific environmental review may be required for individual projects. Explain that this process is not meant solely to open each and every trail to mountain bikes. A good introduction may allay fears of worried citizens that projects won't be thoroughly reviewed.

In addition to explaining the value of the process itself, the document might explain how this would result in enhancing the trails system, and would address environmental problems based on science, provide managers with a toolbox of mitigation measures, provide for useful checklists, and allow for the potential for mitigated negative declarations or less costly environmental review if possible. The trails programs and measures would be best practices, science-based, standardized and practical. This helps the goals of the California Recreational Trails Plan and resulting progress can be reported to the Legislature and Governor.

The introduction should recognize that there are inequities in the number of miles of trails allocated to the various user groups; that the Department is seeking a balance in addressing demands and needs. It should be noted that equestrians, hikers as well as mountain bikers are all legitimate users of the trails in our amazing State Park system. I hope that the PEIR provides that many of the environmental impacts of making trail adjustments can be addressed satisfactorily by using this first level environmental compliance document.

The introduction could also discuss trail conflicts. Although trail conflict is a social, not environmental impact, this CEQA document can take time to acknowledge that trail conflicts exist, either real or perceived, and can be felt in a number of ways, and vary from person to person. University and other research is available on this topic and solutions and management tools do exist. State trails conferences and National Symposiums have sessions on this topic and there are websites, like www.americantrails.org, which contain bibliographies of useful tools.

The PEIR's potential for avoiding waste of precious resources, assisting superintendents by providing standardized training, and for creating solid environmental compliance should be stressed.

ALTERNATIVES.
Please seek a Preferred Alternative that strikes a balance between user demands, environmental protection, mitigation and allocation of park resources. The scope of the alternatives might consider:

– Evaluating the ratio of miles of trails to the size of the user group. For example, crowding of one large user group on a small number of trails may lead to higher impacts. Dispersing use may relieve some of these impacts.

– Defining a trail so that the desired experience is provided. For example, agree that a fire road is not a trail (but can link single track experiences together) and that a narrow trail may have fewer environmental consequences than a larger road.

– Inventorying trail systems so that park units can identify environmental degradation, barriers, gaps in demands, and implement remedies.

POTENTIAL IMPACTS.
The PEIR could acknowledge that certain social conflict exists, but much of it can be considered, addressed, solved, or mitigated by using various management tools. The PEIR should also acknowledge that each user group has environmental impacts and understand the science of environmental damage to trails by each group. Measures for safety can be included in the environmental mitigation. I urge you to find the available research papers, bibliographies, conference session papers and books dealing with this topic. (For example: www.americantrails.org; www.railstotrails.org.)

The PEIR should have an exhaustive list of these measures available to be put into use. Being able to use mitigated negative declarations rather than EIRs could have the positive result allowing a park unit to efficiently address impacts. Acknowledge that many of the impacts, including social, recur from park unit to park unit and agree that standardizing a response to many of the impacts makes sense. Thank you for a PEIR that provides the framework for checklists, solutions, and measures that is so complete it can be the go-to document for compliance.

POTENTIAL MITIGATION MEASURES.
I believe other comment letters may have provided long lists of great mitigation measures so I will not add my own similar ones. I urge researching various websites as well as session papers from state and national trails conferences. I hope the lists you find to add to the PEIR include: encouraging trail stewardship, collaboration and volunteerism, encouraging connections with communities, training rangers, and pursuing California Recreational Trail Plan goals.

RANGE OF ACTIONS/ASSESSMENT.
Ideas might include:
– Evaluate existing trail conditions and prescribe remedial work to increase sustainability and reduce impacts caused by erosion and sedimentation. Seek sustainability in trail re-routes and design.

– Address inequities in miles and ratio of trails to user groups which may, in turn, increase multiple use, or change an existing use. Seek an adequate number of miles for a user group, especially in park units that crowd one user group onto a small number of trails. Recognize that some volunteer trails get built because needs have not been addressed or allocation of trails in a park unit is lopsided. Denying access does not address the problem.

– Seek the least wasteful, most cost-effective, but environmentally responsible level of environmental compliance as possible. Create appropriate checklists, solutions and measures within the PEIR, which result in opportunities for using less costly, more efficient environmental review or use of Mitigated Negative Declarations.

– Rotate trail use between different user types to solve some environmental impacts.

– Determine best practices and implement the most effective management measures.

– Re-route non-sustainable, especially fall-line trails. Seek better alignments, sight lines, and flow.

– Identify road-to-trail conversions that can serve to meet trail user demands and improve environmental conditions of a park unit.

– Apply multiple-use applications where appropriate as a goal, rather than fragmented and hard to enforce single-use, especially when protecting habitat and preserving resources.

– Show that a project decision meets California Trails Plan goals.

– Determine that a project is consistent with other plans, including adjacent county and other local trail plans that may have connecting trails.

CONCLUSION.
The repetitive nature of many of the requests, demands, complaints and decisions placed upon the State Parks trails program cries out for this type of process. It is wise allocation of resources to respond to the demands by using a balanced, standardized, useful management process that can be implemented statewide. Site-specific work, where needed, is contemplated by the process. This is a continuing program, the type contemplated by this CEQA provision. Thank you for pursuing it.
If you have any questions, especially regarding studies and research, let me know. Thank you.

Sincerely,

Cathy Haagen-Smit

Road and Trail Change-in-Use Program

CALIFORNIA STATE PARKS

PEIR Comments of Bud Hoekstra

Trails and hike-able roads represent a unique university of experiences for each user, and because uses differ hugely from user to user , trails are traditionally marketed to park-goers by mere geographic location only. The result is that trails (hence parks) are undermarketed to and under-used by visitors.

To clarify my meaning, I give an example [I am preparing a foundation for comments that I will make later in this paper.] Calaveras County's Big Trees State Park offers a number of "destination" trails that take a visitor from a parking area to the groves of the majestic redwoods. One of these destination trails through the redwoods is a loop trail. Big Trees State Park also has a loop trail that consists partly of footpaths and partly of two-track, and exits the park, I believe, onto private land and the dirt road re-enters the park such that a visitor can hike ten miles on a continuous loop and enjoy the rugged exercise and mixed natural sceneries. This loop trail is not showcased in the park's repertory of trails, though veteran hikers see it jump out at them on the map and hike it. Likewise, Mark Twain Hospital's Foundation held a walk-run on one of the park's "destination" loop trails that swings hikers through the redwood groves. The purpose was not destination but health, and running and walking are two different activities. Hiking trails do not always make suitable running trails, because, when a hiking trail edges out on a scenic outcrop, runners could lose their footing and fall off or a needle-point jog to a vista could be missed, with the runner slipping off the sudden precipice.

I want to conjure up my imagination for a clearer picture of what I'm getting at. A park can have a hiking trail from the parking lot to Logger Camp, a destination trail. It's 5 miles to Logger Camp and 5 miles back on the same trail, a 10-mile destination trail. By same token, a visitor could hike 5 miles to Logger Camp, take a 3-mile trail to another parking lot and walk back two miles to the original parking lot by the road, making a 10-mile loop trail to hike. A destination trail and a loop trail are one and the same footpath, put to a different use. If one classifies the trail by geographic location, there is only one trail – however, if one classifies or markets the trail to visitors by use, there are two uses, loop and destination, seemingly making two trails.

One more step: The same visitor tramps to Logger Camp and then takes a one-mile spur trail to Logger Lake, because the birding is good at Logger Lake. Just imagine it for purpose of illustration. Now the same trail serves as a 12-mile roundtrip "destination-birding" trail. Or maybe the entire trail is good for bird-watching. Meanwhile, the birder with his binoculars encounters an ultra-runner on the same trail. The ultra-runner, running with his "pacer" at night, began at an overlook outside the park and in the national forest, ran all night long, emerged and ran the morning to Logger Lake. She or he skirts Logger Lake, dashes to Logger Camp and out to complete the 93-mile run. The same trail, classified by use, is hike, scenery, wildlife and running. Traditionally, park managers refer to this development as "multiple-use" but the term applied belies the fact that each user has a different route and different recreation in mind.

Maps tend to have surface structure, the actual physical location of the trail on paper, but the deep structure, often affecting maintenance and change-of-use, dictates the multi-use, how one trail figures into multiple routes that reflect different uses.

Use dictates how a trail tread is maintained. Hiking trails can have needle-point or blind turns, and these blind turns are a dangerous mix with mountain bikers who sprint out of nowhere. And equestrians passing through on a horse trail may have their sentinel dog with them. Sadly, state parks ban companion animals, even on a leash, on all trails. A good change-in-use opportunity would be to designate one trail per park that is a leash-only trail for dog-owners. Human traffic is so heavy on some trails that a companion animal makes no dent in wildlife dynamics.

It is also useful to recognize seasonal use and off-season use of trails. Outside state parks, a recreation trail may be frequented by hunters in the fall, and hunting can be incompatible with running, unless the runner doesn't mind an occasional barrel pointed at him, before the hunter realizes the noise is a runner. Hiking trails that alternate as ski trails in the winter months require a different tread and layout design.

A good trail system management plan has a map of the trail's fixed location and then overlays that highlight various trail uses. Trail A, for sake of illustration, may take the birder half-way to Logger Lake but may take the climber half-way to Logger Peak where the vertical pitches are and may take a clique of cavers all the way to their spelunking destination at Logger Camp. Physical location, a map, tells users next to nothing about the trail, the conditions of travel and the popular uses.

One of the functions of trails is transportation, to move a hiker from location X to location Y. Roads join point A with point B. A more important function of the trail, or road, is to concentrate the environmental impacts. A well-trod path through a pasture and marsh preserves the Darlingtonia and orchids from being trampled. A well-designed trail keeps people from straying off the tread into environmentally sensitive areas. This "use" of the trail, though often hidden in the trail's design, is a consideration in change-in-use program.

Sometimes trails and roads need closing or changing for environmental preservation. The root rot attacking Port Orford cedar was vectored by foot wear of thru hikers and by wheels of OHV's. Just to recognize a curious bit of history, broad-leaved plantain, brought to America from Europe, was named "whiteman's foot print" by native Americans, because the weed prefers compacted soil and grows on footpaths. Christiansen-Lambert Dune Preserve saw its first plantain in the dirt parking lot. Mt Airy Forest saw two solid tracks of plantain spring up where trespass vehicles went around restricted gate. Recently in the news, contractors widening a road in Gold Gate Park exposed a rare Manzanita species thought to be extinct in the wild. The Tamiami Trail (auto) in Florida was once discovered to be a death trap for the endangered Florida panther.

There are times and situations when one use is in conflict with another, or when a trail designed to concentrate human impacts on the environment scatters or magnifies those impacts. The circumstances necessitate a change-in-use to protect users, rare species or the environment.

Few people have heard of the term "swale" because it relates to the hydrology of a landscape. A swale or wet meadow has an underlying geology of rock such that the underlying water table is forced to the surface. Sometimes such geology creates an artesian spring or, typically in Florida, an entire river gushes from a cave – see Blue Springs State Park in Florida where the Manitee swim. In Cranberry Glade, West Virginia, the water table is trapped in a geologically flat-bottomed bowl that creates a bog and the bog's associated plant life. In the foothills, swales are common; both trails and roads are often designed without forethought of the consequences. The Army Corps of Engineers at Hogan Lake thoughtlessly paved a road to Coyote Point through a swale. The seasonal swale saw the water table rise in the spring and a wet meadow formed, making the road bed unstable. The Army Corps shored it up with culverts, but the road bed was[illegible], and a wet meadow can't be drained in that manner. Next the Army Corps added horticultural textiles to road bed to strengthen it. Finally, failure after failure, the Corps resorted to trenching two trenches, meeting in a V at the culvert, which drained the direct flow surfacing in the wet meadow. Not all meadows are seasonal swales. Flood plain meadows, grazed meadows, "prairie" meadows co-exist. Few people realize that fire maintains prairies like Lynx Prairie in the Midwest, a relic pocket of prairie when the prairie west of the Mississippi River moved eastward to the Allegany Mountains in the East. Without fire, trees invade Lynx prairie and destroy the relic biology of prairie plants. Likewise, swales are tree-less, not unlike the Everglades river-of-grass. But the water table, like fire in a prairie, keeps trees from taking root and growing.

The Army Corps at Hogan Lake could have moved the road to Coyote Point a 100 yards away through the Manzanita and bypassed the swale altogether, but their engineers didn't recognize the geology that caused the swale. At the Flower Farm in Amador County, the road intersected a swale and the road bed became mush in the spring. The Flower Farm moved the road and converted the swale into a lake. Trails often transect seasonal swales, and users hop out of the muddy tread and make a parallel tread beside the original. Some meadows exhibit four or five parallel trails within two feet of each other. In national forests where grazing is allowed [cow paths make excellent footpaths] , hoofs dig deeper and deeper in a path transecting a meadow until the depth intersects the flow of subsurface moisture and drains the flow. At crucial times in the spring, grass above the path is green where the water table survives, and below, where the path drains the table, the grass parches brown early. Park crews making trails often come upon meadows in the foothills surrounded by Manzanita and occasional bull pine or oak trees. The impulse is to save money and cut the trail through the meadow, not realizing that the meadow is a seasonal swale and the tread will be mucky in late winter and spring, that the trail will drain the table that makes the meadow and eventually change the landscape by changing the surface hydrology.

The trail-keeper who encounters a wet meadow trail often thinks – "this trail is wet in the spring, can't have horses! Can't be mountain biked!" A change-in-use masquerades as a management fix to a needed redesign and change-of-location.

The 4 September 2010 NEW SCIENTIST breaks the story about Tanzania's plan to wedge a commercial road in the North of Serengeti National Park, interfering with the migratory route of 2 million wildebeest and zebra. The road, it is believed, will cut wildebeest off from dry season watering holes and result in as much as ¾'s population loss. Equally risky is the road's pathway for livestock diseases that could dwindle the wildebeest population that predator populations depend on.

The change-in-use program at state parks must consider what impacts a change-in-use may cause on wildlife and other resources. That's an obvious consideration. Technically, cow birds, once associated with buffalo herds of North America, parasitize the nests of warblers in the forest. Generally, cow birds like an open area and invade a forest regime only with in fifty feet of the open corridor. A foot path or narrow bike path through a forest preserves the warblers for bird-watching. Widening the foot path to accommodate OHV'ers, for example, creates an open corridor that fosters cow birds and depresses the song bird population. The change in use from shaded forest trail to open corridor results in penetration of the forest by cow birds and the loss of song birds whose nests are parasitized. One small change in use has enormous consequences for the landscape.

These comments are meant to generate a well-rounded discussion of a change-in-use program.

Bud Hoekstra

Submitted by Bud Hoekstra

POB 455

San Andreas, CA 95249

budhoek@yahoo.com

209-293-3432

Appendix C

Trail Use Conflict Study

DRAFT

Trail Use Conflict Study

California State Parks

Road and Trail Change-in-Use Evaluation Process

PREPARED BY:
Alta Planning + Design
PREPARED FOR:
Ascent Environmental, Inc.

June 2012

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DRAFT

Trail Use Conflict Study

California State Parks Road and Trail Change-in-Use Evaluation Process

June 2012

Prepared by Alta Planning + Design

Randy Anderson, Principal in Charge, Project Manager

Hannah Kapell, Assistant Project Manager

Matt Berkow, Planner

Robin Wilcox, Planner

Catherine Sherraden, Project Assistant

Prepared for Ascent Environmental, Inc. and California State Parks

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List of Acronyms

APBP	Association of Pedestrian and Bicycle and Professionals
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CETLC	California Equestrian Trails and Land Coalition
COSCA	Conejo Open Space Conservation Agency
CSP	California State Parks
EBPRD	East Bay Regional Park District
EIR	Environmental Impact Report
FHWA	Federal Highway Administration
IMBA	International Mountain Bicycling Association
LTBMU	USFS Lake Tahoe Basin Management Unit
NOP	Notice of Preparation
NPS	National Park Service
PEF	Project Evaluation Form
ROMP	Responsible Organized Mountain Peddlers
RTC	Rails-to-Trails Conservancy
USFS	U. S. Forest Service
VCPRD	Vancouver-Clark Parks and Recreation Department

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Glossary

Clear area	Continuous, linear zone around trail free of obstruction to allow for safe, unimpeded travel.
Clearing height	Vertical clearance of obstructions across the width of the trail.
Trail bed or tread width	The width of the relatively level graded area created or utilized for the trail. In many cases the graded edges of the original trail bed slough so that the available width for the trail tread is reduced.
Trail corridor/ right-of-way	The width and boundaries where a trail is following a physical corridor, such as a road right-of-way, utility corridor, or former rail line, and/or a defined access easement corridor.
Trail shoulder	Natural surface, graded area, contiguous and flush to the trail tread, allowing a transition from the tread to natural terrain.
Trail tread	Actual surface portion of a trail upon which users travel excluding the backslope, ditch, and shoulder.
Hillslope, sideslope	The steepness of the slope on which the trail is constructed, or the resulting slope steepness adjacent to the trail after construction.
Front-country	Park areas that are within or close to urban areas. Many users are able to visit.
Back-country	Park areas that are relatively remote, and fewer users will be able to visit because of distance from trailheads and terrain.

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Preface

The Trail Use Conflict Study has been conducted to provide information relevant to issues raised by trail user groups regarding their concern that potential for conflicts between trail users may occur as a result of adding uses to California State Parks (CSP) trails under the proposed Road and Trail Change-in-Use Evaluation Process.

While trail use conflict is an important issue for the management of CSP trails, as a social topic it is not included in the definition of environmental impacts under the California Environmental Quality Act. Nonetheless, because of the importance of the issue, as demonstrated by public input to CSP regarding trail management and scoping comments on the Road and Trail Change-in-Use Evaluation Process Environmental Impact Report (EIR), CSP commissioned the Trail Use Conflict Study to provide an up to date understanding of how trail use conflict is addressed by other agencies with responsibility over recreational trail development and management.

The study is provided as an appendix to the Road and Trail Change-in-Use Evaluation Process Program EIR in recognition of the topic's importance to trail management.

Chapter 1. Introduction and Summary

1.1 Introduction

California's recreational trails provide experiences that attract more users than any other recreational facilities in the state. The ability to exercise and enjoy nature in the outdoors is critical to the physical and mental health of California's population. California State Parks (CSP) considers trails to be primary state park facilities that offer health-enhancing recreational opportunities and access to park resources for interpretation and education and has developed a policy and coordinated set of planning guides to manage state park trails. CSP adopted the policy to provide trails for accessing park features and facilities and to strive to meet the recreational, educational, and interpretation needs of its diverse trail users. The CSP Trails Handbook serves as CSP's primary guideline for trail design, construction, operations, and maintenance (CSP 1994). The *California Recreational Trails Plan* provides a guide to management of an integrated system of trail routes to serve California (CSP 2002).

One of the goals of the *California Recreational Trails Plan* is to promote multi-use trail cooperation, recognizing that efforts to integrate or combine different uses on trails have not all been successful. The goal is to "provide the maximum opportunities for the public use of trails by encouraging the appropriate expansion of multi-use trails." CSP is proposing to implement statewide its Road and Trail Change-in-Use Evaluation Process (Process) to assist District personnel in evaluating which existing trails are appropriate for adding or removing trail uses. In reviewing and refining the Process for statewide application, CSP has been considering the influences of trail use conflicts that can occur when multiple types of trail users are present on a facility. This consideration includes a study of the current state of information and understanding of trail use conflicts and approaches for trails managers to address them.

This Trail Use Conflict Study (Study) reflects review of literature and practice nation-wide for addressing user conflict on natural surface multi-use trails. It is an important contribution to the subject of multi-use trail design and management. This Study is specifically focused on CSP trails. CSP has taken a leadership role in addressing the complex physical and social issues that pertain to accommodating multiple users, such as hikers, equestrians, and mountain bike riders, on the same trails. This leadership is consistent with the overall CSP mission and policy to "encourage hiking, horseback riding, and bicycling as important contributions to the health and welfare of the state's population" (Public Resources Code Section 5070-5077.8), as well as the Trails Policy (Policy Notice 2005-06) and the *California Recreational Trail Plan*, to provide appropriate access to nature-oriented, trail opportunities for all Californians.

This Study provides background information for a Program Environmental Impact Report (Program EIR) for CSP's proposed application of the Road and Trail Change-in-Use Evaluation Process (Process) throughout the State Park System. CSP developed the Process to provide criteria for use in consistently and thoroughly evaluating and responding to proposals for change in designated use on existing road and trail alignments.

Two of the objectives of the Program EIR are to conduct a comprehensive environmental analysis of the Change-in-Use Process and, where applicable, to improve upon the existing Process by providing CSP field staff with additional evaluation tools to assess requests to add or remove uses on existing trails and roads in the State Park System. This research helps refine the set of best management practices used by CSP for implementation of change-in-use actions to support the Program EIR's second objective.

1.1.1 Study Goals

This Trail Use Conflict Study has two primary goals:

1) To inform readers of the Program EIR regarding trail use conflict and the nature and extent of the problems as revealed through review and analysis of documents and articles on the subject. The Study provides a summary of the nature of trail use conflict and potential solutions as identified through review of the relevant literature and a survey of trail system managers. The Study draws conclusions regarding the results of the research and their relevance to the CSP trail system and the existing Process.

2) To improve the ability of the existing Process to guide decision-making related to trail use conflict through recommended refinements and enhancements to the existing evaluation tool, trail design guidelines, and best management practices. The existing CSP trail design guideline and management measures that help avoid or reduce trail use conflict are reviewed as part of the Study.

This Study provides two sets of recommendations related to the consideration of proposed road and trail changes-in-use. The first recommendations presented are contained in a Checklist for Low-Conflict Multi-Use Trail Design. This clarifies how trails can be designed to comfortably and safely accommodate a mix of hikers, equestrians, and mountain bicyclists, and comply with rules and guidelines for safe, considerate, and low-impact use.

Management of trail use conflicts depends on compliance with the appropriate type of trail use, and rules and guidelines for trail use and behavior, including reasonable speed consistent with trail design and use objectives, yielding to other users per the "yield triangle" (which informs trail users when to yield to other types of users), warning when passing, and having the appropriate knowledge or skill to be on trails shared with other users. The second set of Recommendations is contained in a Checklist for Multi-Use Trail Conflict Management. This contains measures for getting the information to the trail users about appropriate trail use; monitoring trail use, encouraging compliance, and where necessary, responding to situations of non-compliance that can result in conflicts.

1.1.2 California State Parks Trail Policy Setting

Although the research and recommendations presented in this Study are relevant to the CSP trail system, many of the agencies interviewed and documents reviewed for this Study involve non-CSP trail systems with a different mission than CSP. Thus, some of the design and management approaches from these sources, while informative, may not be appropriate for CSP trails.

CSP provides trails to allow people to experience and enjoy nature. This is clearly established in the California Public Resources Code (emphasis added):

> 5019.53. **State parks** consist of relatively spacious areas of outstanding scenic or natural character, oftentimes also containing significant historical, archaeological, ecological, geological, or other similar values. The purpose of state parks shall be to preserve outstanding natural, scenic, and cultural

> values, indigenous aquatic and terrestrial fauna and flora, and the most significant examples of ecological regions of California . . .
>
> Each state park shall be managed as a composite whole in order to restore, protect, and maintain its native environmental complexes to the extent compatible with the primary purpose for which the park was established.
>
> Improvements undertaken within state parks shall be for the purpose of making the areas available for public enjoyment and education in a manner consistent with the preservation of natural, scenic, cultural, and ecological values for present and future generations. Improvements may be undertaken to provide for recreational activities including, but not limited to, camping, picnicking, sightseeing, nature study, hiking, and horseback riding, so long as those improvements involve no major modification of lands, forests, or waters. <u>Improvements that do not directly enhance the public's enjoyment of the natural, scenic, cultural, or ecological values of the resource, which are attractions in themselves, or which are otherwise available to the public within a reasonable distance outside the park, shall not be undertaken within state parks</u>.

Although Public Resources Code Section 5019.53 mentions only hiking and horseback riding, policies regarding access to mountain bikes on trails have since been added (State Park and Recreation Commission, Policy IV.2, Non-Motorized Bike Use. 2005), and CSP's mission now includes accommodating mountain bikes on trails . The same principles apply: CSP trails are not designed or intended to serve as active recreation facilities where nature appreciation may be secondary to athletic or skill challenge. Mountain bike speed or technical riding, equestrian endurance or poker runs, and group trail runs are examples of activities that are not compatible with CSP trails, shared or otherwise. CSP trails are generally designed to accommodate a passive, nature-oriented type of shared trail use by combining the design requirements for each individual use into a trail on which they can comfortably mix.

1.1.3 Research Scope

The research for this Study includes a review of existing literature pertaining to trail use conflict issues, as well as a survey of U.S. agencies and organizations that manage significant mileage of multi-use trails and may have information or informed opinions about the nature of the problems and potential solutions. The literature review was limited to documents from the U.S. and Canada, but it includes research examples from other countries where they are cited in U.S. or Canadian documents.

This research effort focused on natural surface trails in natural land settings comparable to units of the California State Park System. It focused on multi-use trails with a combination of hikers, equestrians, and/or mountain bikers, and conflicts between these groups. Although conflicts on paved trails were frequently mentioned in the responses, paved trails are not a focus of this Study because the Road and Trail Change-in-Use Evaluation Process does not address paved trails. Also, although conflicts regarding dog access were mentioned in some responses, they are not addressed, because dogs are typically prohibited on CSP trails. This Study also does not address the relative maintenance or environmental impacts of different trail use types, which are subjects of the Program EIR and a separate erosion vulnerability study.

The research sought to identify when, where and why trail use conflict incidents occur on the trail system; which user groups are most often perceived to be in conflict; and what strategies are used to minimize conflict concerns. The research also sought to determine the most prevalent types of conflicts (users involved, specific reasons, frequency, etc., as measured in complaints); what factors exacerbate or alleviate feelings of conflict; and strategies that managers have found to be successful in addressing conflict.

The research sought data reflecting rigorous study of use conflict and solutions, however, few studies have empirically measured the nature of trail use conflicts or the effectiveness of solutions. The research results highlight the most thorough, objective, and often-cited government or academic research, and planning, design, or management standards or guidelines that address multi-use trails.

1.1.4 Study Notification and Input

The Study team (CSP staff and consultants) developed the initial list of documents to review and agencies to survey based on internet research, including academic and professional sites, and input from CSP staff. The team strove to make the list as inclusive as possible by seeking suggestions of pertinent information or experience from the public, agencies, and organizations.

At research initiation, the people who signed in at the Notice of Preparation (NOP) scoping meetings or who made subsequent comments on the scope of the Program EIR during the scoping period received a notice of the study and solicitation for additional documents, data, and knowledgeable contacts. The notice was also sent to trail-related organizations and posted on major trail-related web sites, as shown in Table 1-1. The research considered all suggestions received through this process; if the Study team found that a document was not directly pertinent to this Study, this was noted, and the document was not included in the annotated bibliography.

Table 1-1. Study Notice Placement

Group	Method
American Trails website	Posted
Association of Pedestrian and Bicycle and Professionals (APBP)	E-mail to list serve
Individuals who signed into the NOP scoping meetings	E-mailed
International Mountain Bicycling Association (IMBA)	E-mailed to staff
Rails-to-Trails Conservancy (RTC)	Sent in April member e-newsletter
Responsible Organized Mountain Peddlers (ROMP)	E-mailed to staff
Sierra Club	E-mailed to staff

Comments and documents provided through these resources are listed in Appendix D.

1.1.5 Organization of the Document

Chapter 1 of this Study introduces the purpose and research scope for this Study. It clarifies the setting and use characteristics considered in the Study, and summarizes the findings derived from the research.

Chapter 2 presents the recommendations related to appropriate trail design as well as management and outreach strategies to address trail use conflict.

Chapter 3 summarizes the overall research results from the review of relevant literature and survey of trail managers regarding conflict issues, appropriate design solutions, and management solutions for addressing user conflicts.

Chapter 4 provides a bibliography of the literature and agency staff comments cited in Chapters 1 through 3.

A glossary with list of acronyms used in chapters 1 – 3 is provided after the Table of Contents.

These chapters are supported by the following appendices:

- Appendix A provides the recommended design and management measures in summary checklist forms and examples of how the existing CSP documents used for the Change-in-Use Process can be modified to incorporate the measures and related recommendations.
- Appendix B describes the methodology used for the review of the literature and discusses the results by topic. It also includes summaries and critiques of the "key" documents that provided the most pertinent information for this Study.
- Appendix C describes the Agency Survey, including methodology, agencies surveyed, and an analysis of results by topic for the 36 surveys returned. The chapter also provides an overview of the findings from the most pertinent individual surveys received. These were agencies that had environmental settings, trail systems, and/or policies most similar to CSP, and that provided specific data and recommended measures regarding trail use conflict. Appendix D outlines the outreach conducted to user groups for the Program EIR and this Study, as well as the comments and recommendations received.
- Appendix E provides the list of literature considered in the review, as well as a complete annotated bibliography of all literature reviewed that was determined to be relevant to trail user conflicts.
- Appendix F lists all surveys returned.
- Appendix G presents relevant portions of the current CSP *Trail Handbook* and draft unpublished CSP trail design guidelines.

1.2 Summary of Research Findings

Analysis of the data collected shows that the primary management concern on multi-use trails is conflict based on users' perceptions and behaviors, and that actual accidents involving different user types were rare. The overall findings regarding the nature of trail use conflicts, including potential solutions to these issues, are based on a substantial body of data and informed professional and expert opinion.

1.2.1 Types of Conflict Reports or Events

The research found that evidence of trail use conflict was represented in three basic forms: general comments or complaints, conflict incidents, and as a subset of the incidents, accident events. Clarification of these terms is important to understanding the results:

- "General comments or complaints" are general issues raised that do not include documentation of a specific incident event. These general concerns were often represented in opinion surveys of trail agency managers or trail users that were included in the literature reviewed, or were expressed in the survey of trail agency managers conducted as part of this Study.
- "Incidents" are events that were brought to the attention of trail management staff, typically involving a specific concern or complaint. Incidents can include wildlife encounters and a range of other issues,

but when related to trail use conflict, they tend to involve one user feeling that his/her experience was diminished and/or his/her safety was threatened by another user, and/or a violation of the rules occurred. Incidents include both non-accident and accident events.

- An "accident" event is a type of incident where someone is injured, or falls, but avoided injury. An incident report could include details of an accident. This could be a single user event, or multiple users of the same type, or multiple users of different types. .

1.2.2 Reference Citations

In the following summary findings, where a theme was cited by one or more sources, the reference follows. If several sources supported the finding, the text provides general reference to support without specifically identifying all documents or agencies. These findings and the supporting documentation are presented in more detail in Chapter 3 and 4 and Appendices B and C.

1.2.3 Significant Research Findings

Six significant conclusions were derived from the Literature Review and the Agency Survey results. These findings are listed below, with supporting documentation.

1. **Information on trail use conflict is primarily based on opinion; little data about actual user conflicts are available.**

The existing literature and the survey responses primarily consist of the opinion of trail system managers and users; even peer-reviewed academic or U. S. Forest Service (USFS) publications primarily rely on manager and user surveys. There is limited detailed report data about actual trail use conflict incidents, such as complaint or incident reports, rigorous analysis regarding the nature and extent of trail use conflict issues, or the results of strategies addressing them.

While there is a wealth of documents and articles on the topic of user conflicts on multi-use trails, the majority of the literature does not provide empirical data regarding the presence, extent, or attributes of user conflict incidents. Although 63 of the 80 Literature Review sources define the problem of trail user conflicts, several of them do so as a presupposition based on previous literature (14 sources), or the author's experience (13 sources). Several sources present surveys on managers' perceptions of conflict (9 sources) or users' perceptions of conflict (22 sources). None of these surveys asked the frequency of actual incidents. However, this notable lack of citations regarding specific incidents, including accidents, implies that they are infrequent.

The Study team requested incident and complaint data from each agency sent an Agency Survey. This request was reiterated when surveys were returned. The survey also asked respondents to provide their professional judgment about the frequency of complaints, which may include formal written complaints or discussions at events, public meetings, or other feedback. Respondents were also asked about the frequency of accidents with injuries due to collisions, non-injury collisions, and 'close calls' negatively affecting user experience.

The survey responses showed that agencies rarely maintain detailed data on complaints, incidents, or accidents. Where data are collected, incidents (including accidents) involving multiple user types are often combined with single user or same user types of accidents and separate statistics are not available. Though the research results reflect primarily informed opinion rather than empirical data, there is clear evidence that accidents are rare compared to the number of incidents, and actual incidents tend to be rare in relation to extent of comments and complaints about conflict between trail user types.

2. Complaints and controversy about other trail users are common.

Several manager and user surveys from the Literature Review indicate the importance of trail use conflict as an issue for trail managers. Over half of the 40 recreational managers from the USFS and U. S. Bureau of Land Management surveyed via telephone reported conflicts between mountain bikers and other user groups (Chavez 1993). A survey of state park Directors of all 50 states found that 77 percent reported trail use conflict as an issue (Schuett 1997). A survey of USFS Managers in the 1990's found that over a third (34 percent) of National Forest managers were concerned about mountain bikers' conflicts with other user groups. This topic was second only to concerns about effects on natural resources (42 percent); (Chavez 1996a).

The Agency Survey found that complaints of conflict are relatively common compared to incidents, based on staff estimates of the frequency with which they receive complaints. Agencies typically receive complaints on a monthly or weekly basis (13 of 25 agencies), and more than two-thirds of the 36 agencies that returned surveys felt that they had significant issues with user conflict on natural surface shared-use trails.

In addition, the extent of literature written on the subject and plethora of studies indicates the contentiousness of the subject of sharing uses on trails.

3. Actual incidents, including those involving accidents, between trail users are relatively rare.

Most agencies group information about all incidents and accidents between users together. However, in some cases it is possible to separate incidents that do not result in injury or a physical altercation.

An Environmental Assessment for the National Park Service (NPS) recorded users on a section of the Cactus Forest Trail in Arizona during a six-month trial period, finding only three minor incidents, including two user complaints and a ranger reminding a mountain bicyclist to yield to equestrians (NPS 2003)

Resources from the Literature Review that consider accidents on trails found there to be a very low frequency of accidents, in general, and few of these involve multiple user types. An early study in the East Bay Regional Park District (EBRPD) found 24 cycling accidents reported from July 1987 to June 1988. Among the accidents, two cases involved two mountain bikers colliding and one involved a cyclist falling to avoid a hiker (Morioka, Steven in Sloan, D. and T. Fletcher, Ed. 1989).

Literature that does not provide data on accidents, but which relies on opinion surveys of trail managers, supports the conclusion that accidents are rare, compared to conflict incidents. The USFS Manager survey found that only 13 percent of managers had "safety concerns" (including wildlife encounters and conflicts with automobiles at trail crossings) related to mountain bikers (Chavez 1996a). A survey of Ohio State Parks and Park Districts about mountain bike management found that 30 percent of the respondents had observed or received reports of user conflict related to mountain biking, while 27 percent reported accidents, and 13 percent reported safety problems of all types (Longsdorf 2006).

In the Agency Survey, the few agencies that record incidents seldom differentiate incidents related to multi-use, but combined incidents are relatively rare in the context of overall trail use levels. Eight of the agencies in the Agency Survey collect incident data, and four of those had not had any recorded incidents. The majority of agency representatives surveyed responded that, in their professional experience, actual incidents are uncommon; 18 of the 28 agencies responding to the question reported that incidents occur annually or less frequently.

4. Trail use conflict is an important social issue.

There is a strong body of study and informed opinion indicating that trail use conflict is an important social issue, and that the orientation, perception, attitude, and behavior of users are major factors in generating concerns and complaints about trail conflict. Though it tends to be social/perceptual, rather than represented by significant physical evidence, trail use conflict is a very real issue for almost all multi-use trail managing organizations.

Conflicts between trail users are shown to be highly influenced by perception, attitudes, and behavior on both sides of conflicting parties. Conflict has been described in the literature as goal interference, which can be either interpersonal (based on physical presence of other users) or social (based on perception of a group; no contact or sighting has to occur) (Jacob and Schreyer 1980; Moore 1994; Carothers, Vaske, and Donnelly 2001; Cessford 2002; Bradsher 2003; Chiu and Kriwoken 2003). Moore (1994) wrote that "conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users." Watson, a researcher with the USFS, observes that perceptions of conflict are frequently unrelated to measurable incidents of interference in outdoor recreation, but rather reflect an attitude towards wilderness and stereotypes of other user groups (Watson 2001)

USFS Lake Tahoe Basin Management Unit (LTBMU) staff noted that use conflicts are "very subjective and determined by individuals" (LTBMU response to CSP Trail Use Conflict Survey, 2011). Three agencies noted entrenched negative perceptions of other user groups arising from a history of conflict or disagreement; CSP Gold Fields District, the Front Country Trails Multi-Jurisdictional Task Force, and Jefferson County Open Space all cited historic conflicts contributing to an environment where managers had difficulty addressing root causes of conflict perceptions.

Reported conflicts between trail user types tend to reflect perceptions of being unsafe or merely bothered, due to the presence of other types of trail users. Many of the comments received from the Program EIR scoping meetings stated that conflict is related to mountain bikers failing to yield or passing too quickly. Similarly, common concerns related to user conflicts in both the Literature Review and the Agency Survey include mountain bikers' speeds and lack of warning and/or yielding when passing. Of the 36 surveys completed, the most frequently-noted conflicts were between pedestrians/hikers and bicyclists/mountain bikers (68 percent). The second most frequently-noted concern was conflicts between users with dogs and those without (41 percent), but dog access is not within the scope of this Study, because dog walking is generally not allowed on CSP trails. Only 18 percent of issues cited in the Agency Survey were between equestrians and mountain bikers, despite this being a prevalent concern in the Program EIR scoping comments.

Six percent of the survey respondents noted that the users' purpose of visiting the trail influenced their behavior; conflicts between recreationalists and families were mentioned. Less-frequent conflicts cited were caused by meet-up groups and running clubs or other users traveling side-by-side and blocking the trail.

Comments at the Program EIR scoping meetings included concerns that mountain bikers' speeds discourage equestrians and hikers from using the trails.

5. Design of trails to accommodate multiple use helps to avoid or reduce conflict.

There are common themes, but there is also significant variation, in trail design principles in the literature and agency practices to address low-conflict, multi-use trail design, or user-specific trail design. Many agencies and organizations incorporate a few of these principles into published trail design standards or guidelines, but few trails have actually been designed and constructed from the outset using these multi-use design principles. Although informed opinion expressed points about the performance of these designs in addressing trail conflict, no data about actual use and frequency of trail conflict incidents were found.

Several documents from the Literature Review support the use of appropriate trail design as critical to managing multiple use. Similarly, in *Trails for the 21st Century*, Flink, Olka, and Searns (1993) stress the importance of designing a trail with the users in mind, stating that, "accommodating a range of users within a single trail depends on trail width, trail surface, and speed of trail users." A recent study conducted by the East Bay Regional Parks District (EBRPD) found that combining use on trails not designed for multiple use has created management challenges for participating agencies (EBRPD 2011).

In addition, several responses from the Agency Survey note the importance of appropriate design. Eight agencies noted that concerns of incidents more frequently occur at turns and corners or other locations with poor visibility. Inappropriate trail width, slope, and designs that allow users to travel at excessive speed are all circumstances that respondents were concerned would exacerbate user conflicts.

Beyond the conclusion that design is important to address trail use conflict, the Study found that conflict-specific design standards in the literature and agency survey responses varied widely, though there were some principles that were commonly mentioned. The design measures had mixed applicability to the CSP setting. The recommendations in this Study incorporate those that have the most applicability and benefit, along with existing CSP trail design measures.

6. User education and outreach are key methods to avoid or reduce conflict.

There was a strong indication in the literature and in agency comments that active efforts to manage and work with users are necessary to address conflict, although elimination of the perception of conflict can be very difficult to achieve. Several trail user surveys indicated that additional education and outreach can reduce conflicts between users. Users who had experience with other trail activities felt less conflict when encountering participants of those activities than respondents who had never performed those activities before (Bradsher 2003).

1.3 Summary of Recommendations

The Study recommendations to reduce trail use conflict are presented in Chapter 2 and feature two checklists of measures to be used as part of the Process, summarized below:

1) Recommendations for low-conflict, multi-use trail design:

The design recommendations include nine interrelated elements that support low-conflict multiuse natural surface trail design:

- **Tread Width and Passing Space.** Provide sufficient width of the trail tread and existing or created space to allow users to pass each other, either as a continuous condition, or as passing spaces at defined intervals. This also includes vertical clearance from overhanging trees and objects.
- **Sight Distance.** Include adequate length of the trail visible ahead to the user. This is particularly important to resolve in conjunction with speed control features, turns, and sinuous layout.
- **Turn Radius.** Create a minimum inside radius of turns to ensure that they can be comfortably negotiated.
- **Sinuosity.** Lay out a trail with many curves and minimal straight sections (however, with sufficient sight distance). This helps limit the speed of mountain bikers and other users.
- **Speed Control Features**. Install pinch points, choke points, trail anchors, technical trail features, 'stiles', and other elements specifically designed to limit users' speeds.
- **Surface Texture.** Design the relative smoothness, evenness, and firmness of the trail tread to moderate travel speed by mountain bicyclists, including the presence of irregularities.
- **Low Trail Structures.** Avoid steps and waterbar structures that constrain access for horses and mountain bikers and can create points of conflict.
- **Gradient.** Apply design limits or variations in the gradient of the trail to allow for multiple uses.
- **Trail Layout and Classification.** When considering trail suitability for multiple uses, factor the level of use of the trail, availability of alternative trails and routes, and the potential for trails to primarily serve one or multiple user types.

2) Recommendations for multi-use trail conflict management:

Management Strategies:

- **Rules**. Adopt enforceable rules, regarding staying on designated trails, right-of-way, warning when overtaking, speed limits, etc.
- **Enforcement**. Establish enforcement strategies, including monitoring, warnings, radar and citations.
- **User Information**. Provide information to users about rules, polices, and advice for trail user respect, right-of-way requirements, courtesy, routes, destinations, and conditions.
- **Data Tracking**. Collect and track data on trail use conflict incidents and design or management response successes.
- **Separate Trails and Specialized Trails**. Alternate use days, provide one-way trails, and designate use-intensive trails.

User Outreach and Coordination Strategies:

- **Education**. Provide user-specific printed materials and web postings, and/or an active, focused public relations campaigns to educate users about trail use rules and appropriate behavior.
- **User Group Relations**. To establish or improve constructive relationships with user groups, arrange and conduct general meetings with user groups about trail safety or conflict-related issues, or

objectives, such as making improving and maintaining trails and making the trail experience more enjoyable.

- **Volunteer Programs**. Organize, encourage, and /or support establishment of volunteer trail stewardship programs, such as ongoing trail patrol and/or maintenance assistance, specific projects, and help with outreach and education regarding conflict avoidance, safety, and courtesy.
- **Events**. Organize, encourage, and/or support multi-user social, fun, trail construction, or maintenance events (e.g., Trail Clean-up Days).

Checklists that provide more detail about these recommendations are presented in annotated form in Chapter 2 to help explain the background, context and objectives. They are provided in simplified checklist form in Appendix A for ease of use by CSP staff. Chapter 2 describes and Appendix A illustrates how the checklists can be integrated into the existing CSP checklist used to evaluate the feasibility of proposed trail use changes.

Chapter 2. Recommendations for Addressing Trail Use Conflict

This chapter provides recommendations for refining or augmenting the California State Parks (CSP) Road and Trail Change-in-Use Evaluation Process (Process) to help avoid or reduce trail user conflicts on natural-surface, multi-use trails. The recommendations reflect review of existing CSP trail design guidelines and practices and review of guidelines and standards from other agencies and organizations where they were found to be relevant to CSP trail types and policies. These recommendations are intended to become integral parts of the change-in-use evaluation process.

2.1 Summary of Evaluation Process

The Road and Trail Change-in-Use Evaluation Process facilitates consideration of changes in use of existing State Park roads and trails to best accommodate trail access to natural and/or cultural resources for which a park unit was established and that are appropriate for each road or trail facility. The Process seeks to provide CSP with a systematic evaluation tool to consider proposals to modify roads and trails to add or remove particular uses.

The Process includes steps that lead to recommendations regarding change-in-use proposals, as described and shown graphically in the *Proposed CSP Road and Trail Change-In-Use Evaluation Process Flowchart*. (see Figure 2-1). The CSP decisions regarding proposed changes in use may include: approval, denial, conditional approval pending modifications, rerouting to accommodate the changed uses, modifications to planning documents to implement the proposal, deferral of the decision, or management responses instead of physical changes to the trail.

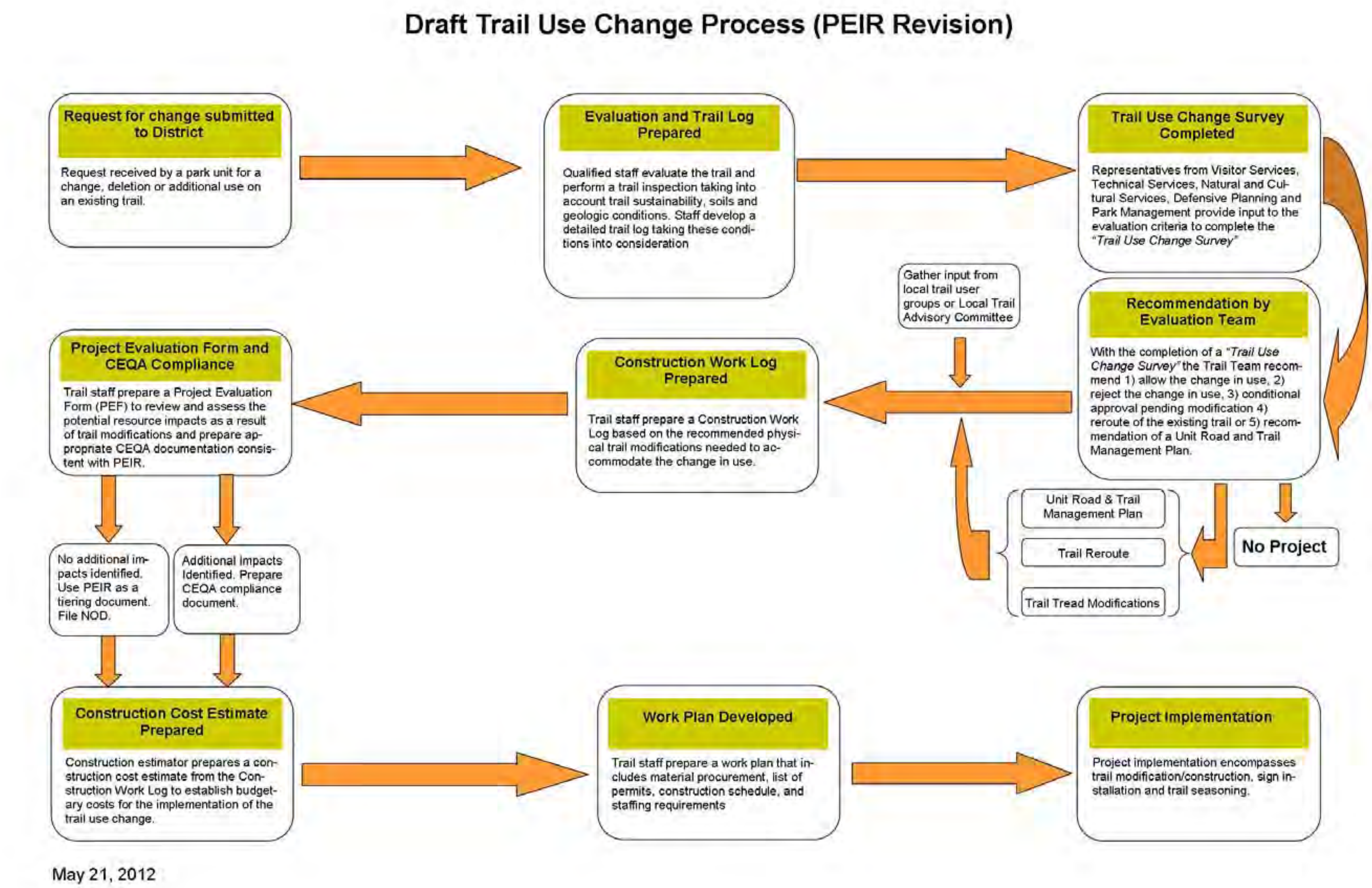


Figure 2-1. Road and Trail Change-in-Use Evaluation Process Diagram

2.2 Incorporating the Recommendations

The recommendations presented in this chapter take the form of two new checklist documents to support the Process:

1) Checklist for Low-Conflict, Multi-Use Trail Design, and
2) Checklist for Multi-Use Trail Conflict Management.

The recommended checklists include specific measures to implement appropriate multi-use trail design for the individual user types and their combination, and specific measures that can be taken to encourage appropriate trail use and behavior, and understanding of other trail users' needs and rights. Research for this Study has shown that, applied together, these measures can minimize trail use conflict.

The recommended checklists are intended to be referenced and incorporated into the Road and Trail Change-in-Use Process by supplementing the existing checklist used to evaluate the feasibility of trail use change. Specific recommended changes to the forms are presented in Appendix A of this Study. A general description of the changes to the forms is provided below:

Evaluation and Trail Log

The Evaluation and Trail Log notes the physical conditions and requirements for the proposed use to be added to (or in some cases removed from) the road or trail. The Checklist for Low-Conflict, Multi-Use Trail Design should be applied at this stage.

The evaluation of existing physical conditions and determination of the implications for improvements to add (or remove) the use under consideration should include review of the checklist, with results reflected in the Trail Log.

In some cases the evaluation may find that conditions and feasible modifications for use-appropriate design do not support an existing use. This could potentially result in that use being removed.

Trail Use Change Survey

The Survey form considers the results of the Evaluation and Trail Log and makes a finding regarding overall feasibility.

The Checklist for Trail Use Conflict Management would be completed in parallel with the Trail Use Change Survey, to inform CSP staff about potential trail management needs and opportunities; not as a direct basis for the decision of feasibility of the proposed use change.

Like the physical conditions or changes pertinent to accommodating specific uses and addressing trail use conflict, the Trail Use Conflict Management Checklist evaluation is not a "make or break" factor in the trail use change decision, but it is an important consideration and part of the ultimate Work Plan.

Work Plan

The Work Plan is the comprehensive implementation plan for the change-in-use project. Completing the Trail Use Conflict Management Checklist will generally identify conditions, accomplishments, and needed actions. As part of the Work Plan an action plan should be developed for management, outreach, and coordination tasks, including follow-up monitoring and reporting of conflict issues and response successes.

Integrating these work elements throughout the Process will help ensure that it is comprehensive and effective.

Monitoring and reporting is already a part of the trail management process. A standardized system of collecting, assessing, and responding to data regarding trail use conflicts, and a centralized database, would help identify "trouble spots" across the state that may deserve special attention in terms of technical support. It could also include requests for local, state or national user group assistance to address the issues identified. If issues can be clearly documented, there is greater potential to provide constructive comments to the parties that may be responsible for inappropriate behavior or lack of understanding of how their use may affect or be perceived by others. Data collection also improves the change-in-use process by measuring the success/failure of specific actions. Designing such a data collection and management system is beyond the scope of the current Study, but it is recommended as an important step in managing multi-use trails.

2.3 Background for Recommendations

Appropriate multi-use trail design and management improves user satisfaction. This can result in users staying on the designated trail alignments and not creating unauthorized or volunteer trails. A higher level of user satisfaction also results in maintaining the use levels of the trail with no significant reduction of trail usage because of user displacement.

The research for this Study entailed review of numerous guidelines, standards, and practices used by local, regional, state, and national agencies and organizations to design and manage multi-use trails. The research sought examples that were related to trail systems in natural settings similar to CSP, with similar allowed uses, and a similar emphasis in trail use policies of providing public access to the resources of a park. The reviewed documents vary widely in terms of consistency with the CSP setting. Even the documents and practices from trail systems that are most comparable typically do not explicitly or thoroughly address ways to minimize conflict through design. Instead they tend to focus on design for low maintenance and environmental impact (together often termed sustainability), and user enjoyment. The goal of the recommended design measures is to identify those design elements that accommodate individual user types (hikers, mountain bikers, and equestrians), as well as combinations of those users in a design that meets each type of user's needs and minimizes the potential for conflicts between them. The most useful new guidance was found in the area of management measures and user outreach, and coordination to reduce trail use conflict. Although CSP documents mention many aspects of these measures, for the most part the recommended management measures are new, while the design measures are built upon existing CSP guidelines.

Natural-surface trail design is difficult to standardize across the country. By comparison, design of the public highway system has been the subject of many decades of intensive study, leading to a shared set of national standards for design and use management. Lack of consistency in multi-use natural-surface trail design standards is due in part to the highly complex and variable settings presented by the wide range of natural and open space landscape types. Also, each managing agency tends to have its own mission, policies, and traditions regarding the appropriate types of use, as well as design.

Through building codes and other standards, common practices have evolved for nearly every type of public facility to ensure they work for the intended use and provide for public safety. Natural-surface, recreational trails are, and logically should be, the "next frontier" in standardization. They are intended to allow people to experience nature on nature's terms and not to standardize nature for their convenience. However, some level of modification of nature is necessary to provide access, especially for mountain bicyclists and equestrians. Bicycle access to nature and all the benefits of nature-oriented trails is clearly a growing need and desire of the increasingly urbanized U.S. population. Access for horses is an ongoing tradition and continues to be a strong demand. Shared use design standards are needed and are gradually emerging, evolving, and being adapted to local, regional, state and national trail settings.

In some respects, as public, multi-use, recreational transportation systems, multi-use trails can be compared to the national highway system – the most standardized end of the transportation project spectrum. The highway system is carefully designed to maximize safety while accommodating multiple user types, including passenger cars, motorcycles, and freight vehicles. These users may individually resent the presence of the other types of user, but they generally accept their right to use the road, and the rules and design features to avoid conflicts.

The Federal Highway Administration (FHWA) Office of Safety aims to ensure and improve safety on highways using a systematic approach that addresses all "4Es" of safety: engineering, education, enforcement, and emergency medical services. As indicated in this multi-pronged approach, design is a key element of conflict avoidance, but incidents can still occur between users for other reasons. There is no comparison between the size, speed, and volumes of traffic on the street and highway system with multi-use trails, but the principles of design and management for use accommodation and safety are the same.

Good design is a critical component of providing low-conflict, multi-use trails, but it needs to be accompanied by education about proper user behavior and enforcement to encourage users to abide by the rules of the trail to minimize trail use conflicts. On the highway system, accidents can never be completely eliminated. When the number or type of accidents reveals a problem, safety measures are prioritized, including redesign, information campaigns, and increased enforcement. Likewise, trail accidents, including those between different types of users (which are already rare), can never be completely eliminated, but CSP and other trail managers work to minimize the risk of accidents. Appropriate evaluation of whether a trail is a candidate for multi-use should consider trail design, behaviors and perceptions of current and prospective trail users that exacerbate conflict, and possible enforcement requirements. Appropriately addressing these considerations could substantially reduce the actual likelihood of trail conflicts, and greatly reduce the perceived concern about them as well.

2.4 California State Parks Trail Design Guidelines

CSP has prepared updated draft trail design guidelines that expand on and update the current *California State Parks Trail Handbook* (CSP 1994). These newer guidelines include improved standards for sustainable trail design and specific guidelines for design of pedestrian, equestrian, mountain bike, and multi-use trails. The draft guidelines include standard design principles to ensure that trails are suitable to the natural environment and can comfortably accommodate the types of uses that are allowed. These guidelines are in current use by CSP staff and will be incorporated into an update of the *Trail Handbook*, which is expected to be issued within one to two years. Previously unpublished relevant portions of the draft updated CSP trail design guidelines (CSP guidelines) are included in Appendix G of this Study, along with relevant portions of the current CSP *Trail Handbook* (1994).

These CSP *Trail Handbook* and guideline excerpts include:

- Current trail classifications and related criteria;
- Trail design guidelines for overall suitability and sustainability;
- Guidelines for multi-use trail design, and;
- Guidelines for use-specific trail design, including mountain bike trails, and equestrian trails.

The Study research identified and evaluated design guidelines documents from many other agencies and organizations for their relevance to CSP trail settings and policies. The objective was to identify measures for accommodating different user types and minimizing conflict on multi-use, natural-surface trails. Design principles in the CSP guidelines often parallel the principles contained in other multi-use trail design guidelines or standards. CSP guidelines are listed in the measures, where applicable. In other cases, where CSP guidelines are inconsistent with another agency's approach, the CSP guideline measures are used, while measures from other guidelines are listed for comparison.

Design for Low-Impact, Low-Maintenance, Sustainable Trails

The current Study is focused on addressing trail use conflict, and does not seek to address design for landform, climatic conditions or the direct environmental or resource impacts of use. Sustainability is an important design consideration for trails in general, including for multi-use trails. A sustainable trail is designed, constructed or reconstructed to a standard such that it does not adversely affect natural and cultural resources, can withstand the impacts of the intended users and the natural elements while receiving only routine or periodic maintenance. It meets the needs of the intended users and encourages them not to deviate from the established trail alignment. Conversely, a trail that has become eroded, muddy, or rough due to poor siting, design, or the impacts of use, could increase trail use conflicts.

CSP trail design guidelines thoroughly address these basic trail factors, which are critical to providing trails that are suitable for the setting, environment, and intended use. There are a number of trail design principles that are commonly cited in trail design references to achieve low-impact, low-maintenance, sustainable trails. The literature review contained in Appendix B indicates whether the guidelines reviewed addressed design in the context of environmental suitability/sustainability. The CSP trail design guidelines exemplify these principles. As part of the overall Road and Trail Change-in-Use Evaluation Process Program EIR, a separate study of erosion potential and control has been prepared to support the Process (Pacific Watershed Associates 2011). This erosion study will also be used to support CSP trail design guidelines, and update the *Trail Handbook*.

2.5 User-Specific Design Considerations

Designing successful multi-use trails requires an understanding of the specific needs, tendencies, and limitations of each user type. CSP trail design guidelines and other design references cover this subject thoroughly. The following paragraphs summarize these considerations as context for the conflict avoidance/reduction recommendations that follow.

Hikers

Hikers are the most flexible trail users and allow the broadest trail designs. Traveling by foot allows hikers to adjust to varying trail conditions, travelling over trails that are extremely steep or barely evident. Hiking trails generally traverse all types of environments, land capabilities, grades and surfaces. While hikers can impact the trail and surrounding resources, upgrading or adding structures to manage impacts of a hiking-designated trail is less problematic than for equestrian or mountain bike trails.

There are baseline design standards for hiking trails in the current CSP Trail Handbook and many other design references. The additional measures to accommodate equestrian and/or mountain bike access are the focus of the Low-Conflict, Multi-Use Trail Design Checklist.

Mountain Bicyclists

CSP design guidelines state that trails open to mountain bikes are intended for the use of the trail to visit unique park resources. Mountain bikers often desire challenging trail experiences including narrow single track, rough or loose surfaces, turns, and relatively steep grades. Aided by ever-advancing technology for light weight, power transfer, traction, and suspension, many mountain bikers are “pushing the envelope” of speed and obstacle negotiation capability. Mountain bikers can attain high rates of speed, particularly on wide trails with good sight lines, flat or downhill grades, and few obstacles. It is not CSP policy to provide trails for fast, highly technical, or adventure rides for mountain bicyclists within the State Park System.

As outlined in the Study findings, mountain bikers’ speeds are the primary reported cause for multi-use trail conflicts. Speed increases the chance that mountain bikers may fall off their bicycle independent of colliding with an object, particularly at turns with loose surface material or steep cross-grades. Speed leads to increased incidents with other users, single-use accidents, and perceptions of user conflicts, particularly if the mountain biker fails to provide adequate warning or passing space, or fails to yield right-of-way to other users. Thus, design of appropriate multi-use trails that include mountain bike access needs to emphasize bike speed control. The CSP trails emphasize speed control in their designs, and this is reflected in the current CSP trail design guidelines.

Mountain bike industry or user group design guidelines and management documents do not always explicitly emphasize speed control, but they often include measures that accomplish this, while placing an emphasis on adding technical challenge over controlling speed. Some of these speed control measures are appropriate in CSP settings, but many technical challenge features suggested by user groups and in some public agency design guidelines are inappropriately artificial and/or inconsistent with CSP policies for trail use in the State Park System. A trail open to mountain bikes in a CSP setting will not approach the challenge level (i.e., steep slopes, obstacles, or sudden turns) that may appear on “technical” or “challenge” trails constructed or allowed by some agencies, or featured in mountain bike parks. CSP trails are designed to place the emphasis on the user access to allow an appreciation of the natural setting and resources, rather than the mode of travel. Trails designed to be more challenging, such as those outlined in mountain bike user group guides and some agency references, may be feasible in California State off-highway vehicle areas, or potentially in California State Recreation Areas (SRAs) that are designated for more developed recreation facilities and uses. Mountain bike parks, such as at ski resorts, are helping to meet the demand for challenge and speed. In any case, design for such specialized use trails is outside the scope of this Study.

Although design to accommodate mountain bikes, including speed control features, is important, to make multi-use trails work, mountain bikers need to be aware of and cooperate with the type of use that CSP trails are intended to accommodate. CSP trail information emphasizes this, and the recommended trail use conflict management measures will help to reinforce this.

Equestrians/Horses

The inherent characteristics of horses are important to understand when considering trail use conflict issues involving equestrians. For instance, horses are herd animals and have the instinct to run when frightened. The U.S. Forest Service (USFS) *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* states that horses and mules are prey animals, and flight is their primary defense (USFS 2007). They become nervous when escape routes are narrow or blocked and can startle when spooked when something comes by them unexpectedly and/or quickly. Any new element that is unfamiliar to the horse, such as a mountain biker, dog, llama, or even a hiker, can trigger this startle instinct, particularly when they appear suddenly. This can lead to a horse running, jumping, turning quickly, kicking, or biting. Because of the height at which equestrians ride, they can be seriously injured if they fall from a horse.

Given these characteristics of horses, other users using equestrian trails must yield the right-of-way. All equestrian trails should have signs that explain right-of-way protocols. When approaching a horse, other users should make themselves as visible as possible, not approach too rapidly, and speak in a low and friendly voice to ensure recognition. Other users should select a wide spot in the trail or an area with a gentle side slope and step off to the downhill side of the trail. Most equestrians prefer to have the uphill side of the trail during an encounter in case the horse bolts. When the horse approaches, other users should not make any sudden movements and should maintain their conversation. The hiker or biker should not step back on the trail until the horse is a full body length down the trail.

Equestrians also have responsibilities to comply with appropriate multi-use trail behavior. A horse that is inexperienced with encountering other types of trail users, especially in combination with an inexperienced rider, can be a hazard to other trail users, even if other users comply with trail use rules and guidelines.

2.6 Checklist for Low-Conflict, Multi-Use Trail Design

The Checklist for Low-Conflict, Multi-Use Trail Design presented below includes explanations and reference to relevant elements from guidelines and standards identified in the national research, and in some cases incorporates them. Design standards from the CSP guidelines are used in preference to guidelines from other agencies and organizations where there is any conflict.

These recommended measures are specifically tailored to apply to CSP trails. They are presented in an annotated checklist form that explains and lists the key design principles identified in CSP trail design guidelines and, where applicable, other Study research trail design guidelines, as effective for accommodating the individual user types and reducing conflict between users on the CSP natural-surface trails, particularly the nature-oriented trails that CSP facilities are intended to provide. The Checklist identifies the specific design standards for multi-use trails as they relate to mountain bike and equestrian use. .

The streamlined Checklist provided in Appendix A is reduced to a succinct list of recommended measures to allow CSP staff to quickly review it as part of the Road and Trail Change-in-Use Evaluation Process. The annotated Checklist in this chapter provides greater detail for completing the evaluation of conditions and needed actions. Many of the design evaluations are not simple measurements or “yes” or “no” answers; they involve careful study and consideration of multiple factors. The Checklist (either streamlined or annotated) will help to ensure that conflict-reduction objectives are considered in the Process, along with the basics of trail layout, design, and environmental protection.

The design recommendations include nine interrelated elements that support low-conflict multi-use natural surface trail design:

- **Tread Width and Passing Space**. Provide sufficient width of the trail tread and existing or created space to allow users to pass each other, either as a continuous condition, or as passing spaces at defined intervals. This also includes vertical clearance from overhanging trees and objects.
- **Sight Distance**. Include adequate length of the trail visible ahead to the user. This is particularly important to resolve in conjunction with speed control features, turns, and sinuous layout as sight distance increases as speeds are reduced.
- **Turn Radius**. Create a minimum inside radius of turns to ensure that they can be comfortably negotiated.
- **Sinuosity**. Lay out a trail with many curves and minimal straight sections (however, with sufficient sight distance). This helps limit the speed of mountain bikers and other users.
- **Speed Control Features.** Install pinch points, choke points, trail anchors, technical trail features, 'stiles', and other elements specifically designed to limit users' speeds and increase sight distance.
- **Surface Texture**. Design the relative smoothness, evenness, and firmness of the trail tread to moderate travel speed by mountain bicyclists, including the presence of irregularities.
- **Low Trail Structures**. Avoid steps and waterbar structures that constrain access for horses and mountain bikers and can create points of conflict.
- **Gradient**. Apply design limits or variations in the gradient of the trail to allow for multiple uses.
- **Trail Layout and Classification**. Consider suitability for multiple uses, factoring the level of use of the trail, availability of alternative trails and routes, and the potential for trails to primarily serve one or multiple user types.

It is important to emphasize that these elements must be combined carefully to work in concert with each other and with other trail design objectives – too much emphasis on one element could detract from other objectives. Relationships between the design elements are highlighted below.

Generally, when more measures can be checked off, the trail will be more appropriate for multi-use; however, there is no specific passing score or correct combination of measures – each trail project is unique.

2.6.1 Terminology

The CSP trail design guidelines and other standards and guidelines use specific terms to define different parts of trails or the setting for trails. The following definitions include terms used by CSP and other common trail design terms used in the recommended measures.

Clear area	Continuous, linear zone around trail free of obstruction to allow for safe, unimpeded travel.
Clearing height	Vertical clearance of obstructions across the width of the trail.
Trail bed or tread width	The width of the relatively level graded area created or utilized for the trail. In many cases the graded edges of the original trail bed slough so that the available width for the trail tread is reduced.

Trail corridor/ right-of-way	The width and boundaries where a trail is following a physical corridor, such as a road right-of-way, utility corridor, or former rail line, and/or a defined access easement corridor.
Trail shoulder	Natural surface, graded area, contiguous and flush to the trail tread, allowing a transition from the tread to natural terrain.
Trail tread	Actual surface portion of a trail upon which users travel excluding the backslope, ditch, and shoulder.
Hillslope, sideslope	The steepness of the slope on which the trail is constructed, or the resulting slope steepness adjacent to the trail after construction.
Front-country	Park areas that are within or close to urban areas. Many users are able to visit.
Back-country	Park areas that are relatively remote, and fewer users will be able to visit because of distance from trailheads and terrain.
Singletrack	Singletrack is a trail that is only wide enough for one person or mountain biker at a time. Singletrack is the most popular or sought after type of mountain bike trail.

2.6.2 Tread Width and Passing Space

A wider trail makes it easier for users to pass each other easily and safely. However, a wider trail may facilitate higher speeds by mountain bikers. Some agencies tend to restrict mountain bikes to "fire roads" and other road-width trails, because there is more room for passing and because there is generally better sight distance. These conditions may result in fewer complaints from other users, in part because these trails are less popular with mountain bikers and they may experience less use. Many mountain bikers seek "single track" trails for their interest, challenge, and better foreground scenery – the same reasons they are sought by other trail users. There is a trend among some agencies toward accommodating mountain bikes on narrower trails, which addresses demand for single track. Single track trails can also be designed to control bike speed more effectively than wide trails, but it is important that adequate passing space and sight distance are available. Singletrack trails would not be a component of CSP's multi-use trail system.

The availability of passing space is more important than the continuous width of the trail tread; both trail tread width and trail bed widths affect the users' ability to safely pass each other.

Measures

Front-country Trails:

1. Where mountain bikes are accommodated, but not equestrians: minimum tread width is 30 inches;
2. Where equestrians are accommodated: minimum tread width is 48 inches;

3. Where hillside slopes are steep, passing spaces are provided at regular intervals (the interval depending on the sight distance available):
   - A minimum of 48 inches wide and 60 inches long where mountain bikes are accommodated, but not equestrians;
   - A minimum of 60 inches wide and 60 inches long where equestrians are accommodated

Back-country Trails:

1. Where mountain bikes are accommodated, but not equestrians: minimum tread width is 18 inches;
2. Where equestrians are accommodated the minimum tread width is 36 inches;
3. Where hillside slopes are steep, passing spaces are provided at regular intervals (the interval depending on the sight distance available):
   - A minimum of 36 inches wide and 60 inches long where mountain bikes are accommodated, but not equestrians;
   - A minimum of 60 inches wide and 60 inches long where equestrians are accommodated

References

Unpublished CSP trail design guidelines (see Appendix G)

Other References:

- To allow hikers, equestrians, and mountain bikers to pass each other on the trail tread, some agencies recommend that the tread should be at least four feet wide (48 inches) (Portland Parks and Recreation, Santa Monica Mountains Area Recreational Trail Coordination Project), (Bondurant, Thompson, et. al. 2009); while others recommend a three-foot minimum (36 inches) (Midpeninsula Regional Open Space District 1993; Minnesota Department of Parks and Recreation; Santa Clara County Parks).
- Narrower trail width is part of a suite of speed control elements that are important for safe shared trails, and also minimize erosion (California Equestrian Trails and Land Coalition 2005). Alternatives to a continuous wide tread include:
  - Build a wide bench that is allowed to overgrow or clear a gentle hillslope (e.g., 20 percent or less) to act as stable shoulder for passing (Santa Clara County Parks; City of Portland Parks and Recreation 2009).
  - Provide passing areas approximately every 1,000 feet (CSP Accessibility Section 2005; Bondurant, Thompson, et. al. 2009). For equestrians, these should be five feet wide by 10 feet long to allow a single trail animal to pull off the tread (USFS 2007).
  - Particularly on trails with treads narrower than three or four feet, maintain good sight distance to make users aware of other trail users in advance.

2.6.3 Sight Distance

Similar to drivers on public roadways, trail users must be able to see ahead a sufficient distance to have time to slow down or stop, or warn and safely pass one another. Effective sight distance is, therefore, a function of user speed; where users are traveling relatively quickly, additional sight distance is required. Also, because some horses tend to be easily startled, additional sight distance is warranted where they are present, especially when sharing the trail with mountain bikes. Other animals, as well as hikers, can frighten horses, so the issue does not exclusively pertain to bikes. However, objectives for adequate sight distance are closely related to limitation of bike speed. CSP trails are not intended for challenge or speed-oriented riding, and a 15-mph speed limit applies to CSP trails statewide. This is the assumed design speed for sight distance, and it is a speed limit consistent with the intended use of the trails for access to and appreciation of nature. Riders who exceed this limit are engaging in inappropriate trail behavior, which is the subject of the Trail Use Conflict Management Checklist.

None of the natural-surface trail design guidelines reviewed provided a data-derived basis for their sight distance recommendations, though sight distance was commonly identified as a critical consideration. The closest approximation of science-based sight distance standard is contained in the Caltrans Highway Design Manual section for paved bike routes in Figure 1003.D (Caltrans, 2009). This chart shows the relationship between speed, slope, and coefficient of friction in calculating sight stopping distances. Although the coefficient of friction may be lower on natural-surface trails than on asphalt, mountain bikes with wide knobby tires may actually attain more friction than road bikes with very narrow tires. Given the great variation in natural surfaces, and difficulty of creating and maintaining a surface with a specific standard for coefficient of friction, sight distance standards for natural-surface trails comparable to the paved trail standards may never be practical. Nevertheless, this subject deserves technical study to at least evaluate the range of sight distances that may be appropriate for natural-surface trails.

While adequate sight distance is needed, long straight sections with long, clear sight distances can also facilitate mountain biker speed. This can be an issue particularly on downhill rides, if other measures are not present to control speed.

Measures

Where mountain bikes are accommodated:

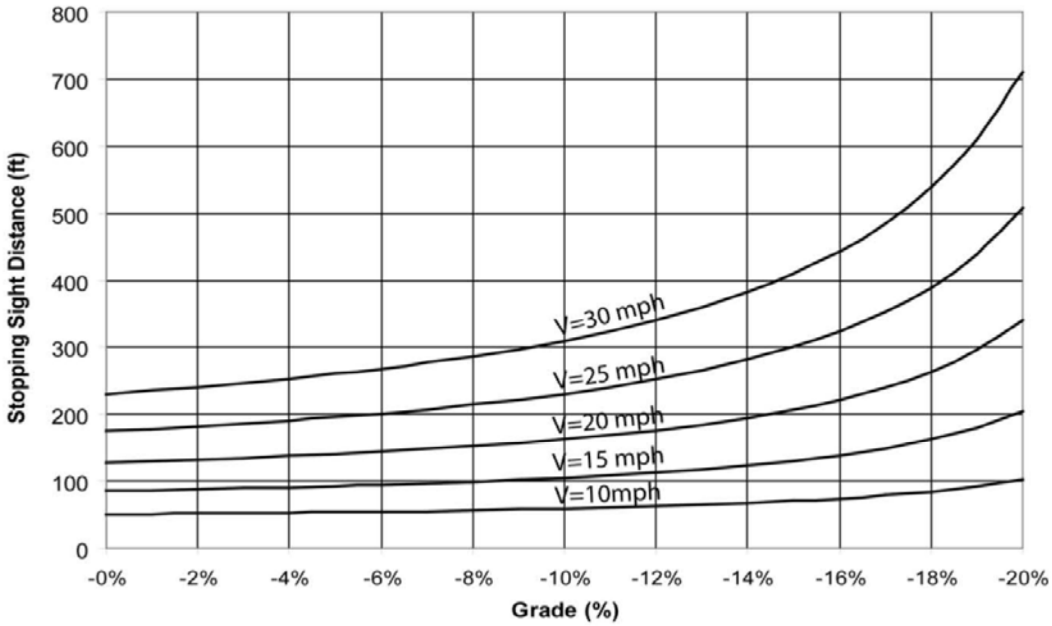
1. Sight distance of between 80 to 200 feet is provided, increasing in proportion to the percent of slope of the trail gradient (0 to 20%+). This assumes that a 15-mph speed limit is posted and generally enforced.
2. Where turns and/or speed control features are in place on a trail segment such that bike speed is controlled below 15-mph, sight distance may be reduced within that segment (but not the portions approaching).

Reference

Caltrans Highway Design Manual – Chapter 1000, Bicycle Facilities (2009)

Other Relevant References:

- Provide a 100-foot average sight distance (USFS 2007; Santa Clara County Parks Department; Flink, Olka, and Searns 1993; Midpeninsula Regional Open Space District 1993).
- Maintain sight lines by regularly thinning overgrowth, especially near curves and speed control elements (Flink, Olka, and Searns 1993; Wade County Parks and Recreation; Front Country Trails Multi-Jurisdictional Task Force).



$$S = \frac{V^2}{30(f - G)} + 3.67V$$

Where : S = Stopping sight distance (ft)

V = Velocity (mph)

f = Coefficient of friction (use 0.25)

G = Grade (ft/ft) rise/run

Figure 2-2. Caltrans Highway Design Manual Figure 1003.D – Stopping Sight Distance – Descending Grade (for paved multi-use paths)

Note: This Stopping Distance/Sight Distance chart applies to <u>paved</u> paths. It illustrates the relationship between factors that need to be considered in combination to determine Stopping Sight Distance on paths or trails in general – particularly the need for increased distance with increased speed and/or grade. Given the great variation in natural surfaces, and difficulty of creating and maintaining a surface with a specific standard for coefficient of friction, such specific sight distance standards for natural-surface trails may never be practical. However, paved paths also have friction and surface variation due to rain, leaves, pavement type and condition, and the above table represents an accepted generalization. This table may provide a template for possible future technical study of Stopping Sight Distance on natural surface trails. A 15 mph design speed may be appropriate, given the prevalence of a 15 mph speed limit/guideline on public multi-purpose trails.

2.6.4 Sinuous Layout

Sinuous trail layout refers to trails with many curves and few, if any, long straight segments. Curves are often necessary to follow the natural topography and geographic features, and to be in concert with the sustainable trail design principle of small trail watersheds. They also can create a more varied and enjoyable trail experience for all users. Curves and turns can be introduced where they are not otherwise required to slow mountain bikes speed.

The "right" extent of sinuosity in a trail cannot be specified outside of the trail setting; some curves are facilitated by topography, or can be routed around groves of trees, rock outcroppings and other natural features. Introduced curves should blend into the natural landscape, at least when trailside vegetation matures. Trees or shrubs can be planted or logs placed to help reinforce the need for the curve.

While sinuous layout is primarily a speed control measure for bikes in the context of reducing trail use conflict, it also helps limit hiker and equestrian speed (e.g. trail running and galloping). Further, all trail users tend to enjoy a more sinuous trail, because they tend to offer more interesting views and varied experiences, compared to long, straight trail sections.

Sinuous, curving alignments need to be designed or reviewed to ensure that adequate sight distance is provided around curves.

Measures

Where mountain bikes are accommodated:

1. The trail avoids long, straight segments (particularly on long downhills);
2. The trail follows a curvilinear alignment with numerous turns created by contouring around the landform, around trees and rock outcroppings, and dipping in and out of drainages.

Where equestrians are accommodated, but not mountain bikes, or even on hiking-only trails, sinuosity can be a desirable feature, but is not as high a priority.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Follow the natural contour of the land, gaining or losing elevation by crossing contour line obliquely, using trail anchors and pinch points, or by weaving the trail between trees and other features (IMBA 2007; Jefferson County Open Space).
- While sinuosity is recommended, turns should not be sudden or too tight for users to safely negotiate, and adequate sight distances must be provided. To accommodate equestrians, turns should have a minimum radius of five feet, with six to eight feet preferred (USFS 2007).

2.6.5 Turn Radius

Turn radius is the minimum inside radius of a turn in the trail that the average user can comfortably negotiate. Trail layout in hilly or mountainous terrain requires climbing turns (preferable, if the terrain is moderate enough to allow) and if necessary, switchbacks. Minimum turn radius is an important design criterion for trail turns and switchbacks, sinuous trails, and introduced speed control features. Horses are generally the controlling factor in turn radii for multi-use trail design.

<u>Measures</u>

Where mountain bikes are accommodated, but not equestrians:

1. Minimum turn radius is four feet for switchbacks (three feet for climbing turns);
2. Grade of the upper and lower leg of the turn does not exceed 14 percent, unless the material is durable enough to support a steeper grade, but in no case should grade exceed 20 percent.

Where equestrians are accommodated:

1. Minimum turn radius is five feet.
2. If the trail is used by pack stock, the minimum radius is six feet.
3. The grade of the upper and lower leg of the turn should not exceed 14 percent, unless the parent material is durable enough to support a steeper grade.

<u>Reference</u>

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Hiking/mountain biking/equestrian trails: turn radii should be 10 feet minimum (City of Portland Parks and Recreation 2009)
- On trail curves and turns, the minimum comfortable radius is 5 feet. When turns are any tighter, stock may stumble over their own legs. Turns with a radius of 6 to 8 feet are more comfortable for both animal and rider. (USFS 2007)
- The minimum suggested radius for a climbing turn is 20 feet (6.1 meters). Climbing turns work best when built on slopes of 15 percent or less. In steeper areas, switchbacks are a better choice. (USFS 2007)

2.6.6 Speed Control Features

These features have many different terms and design concepts in the literature, but the common theme is slowing user speed; with the focus typically on mountain bikes. If designed in concert with natural topography, trees, shrubs, rocks and other site elements, these features can make the trail more interesting for all users, and avoid an introduced appearance. In the literature and practice, many of these features involve literal “choke points” or “pinch points” where the trail narrows between natural features or relocated natural materials, and users are required to weave through a series of features. Another term for a trail segment with several such tight turns is a “chicane”. Some user group and agency guidelines recommend installing challenging obstacles, such as narrow bridges, log jumps, and ramps to slow user speeds and/or create challenge. In a CSP setting these “challenge” or technical features are inappropriate. Speed control features must be designed to be easy for the average user to negotiate, and should not have the form or function of an artificial obstacle or challenge. Elements should be placed so that they provide more of a visual “pinch point” than a literal narrowing (see Figure 2-3). In other words, the trail width is maintained, but viewed from a distance the trail appears narrowed; users cannot travel in a straight line to negotiate the section of trail.

Adequate passing space at appropriate intervals, as well as appropriate sight distance, must be provided in conjunction with the speed control measures.

Measures

Where mountain bikes are accommodated:

1. Otherwise straight trail sections are modified by using natural features such as trees or rock outcroppings, or relocated natural materials such as rocks or logs, to create curves and turns such that users must make a series of turns to negotiate the section,
2. The speed control features are substantial enough in volume that users can easily see them and will not accidentally or deliberately run over them (e.g., 3 to 4 feet high and 4 to 6 feet wide). They are constructed of rocks, logs, or root wads, and may include introduced or naturally occurring native vegetation;
3. They may be combined with a soil mound, but do not consist entirely of a soil mound, as this could be used as a jump;
4. They blend into the natural landscape, at least when trail construction and associated vegetation matures.

Where equestrians and mountain bikes are accommodated:

1. As above, plus a horse can easily negotiate the features (turn radius, width, clearance).

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- The trail 'flow' can be adjusted with anchors, turns, choke points, and surface textures to control speeds (IMBA 2004 and 2007). Speed control features include 'Speed chokes' (Wake County), 'Technical trail features' (Lake Tahoe Basin Management Unit), and pinch points (IMBA 2007; CSP Santa Cruz District) or stiles (Goldstein 1987).
- When designing a trail, leave selected large elements, such as trees or large rocks, and weave the trail around these 'anchors' (IMBA 2007; Wake County Lake Tahoe Basin Management Unit).
- Place two large rocks or halves of a fallen tree on either side of the trail with sufficient space for users to pass (IMBA 2007; Goldstein 1987; CSP Santa Cruz District).
- Maintain good sight lines in advance of speed control features to allow users to slow down in anticipation (IMBA 2007).
- Provide passing areas where users can wait if the feature allows only one user to pass at a time (IMBA 2007).

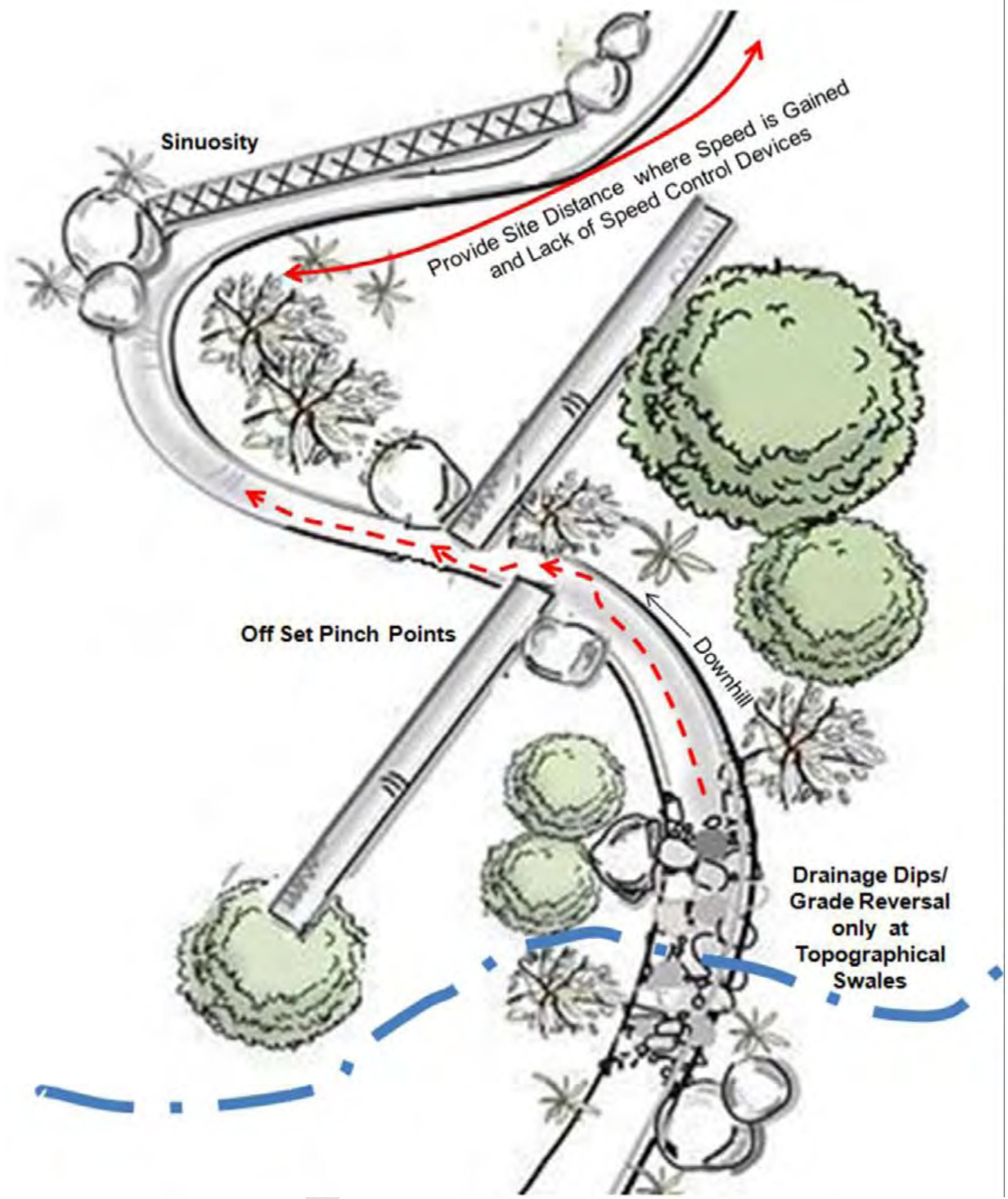


Figure 2-3. CSP Speed Control Measure Concepts

2.6.7 Surface Texture

Surface texture is important for trail safety. There are standards for the relative smoothness, evenness, and firmness of the trail tread and presence of irregularities. CSP and other trail design guidelines pay close attention to soil type, bedrock geology, and drainage to create and maintain a trail that will have a relatively smooth, even tread. However, surface irregularities can be a means of controlling mountain bike speed. Irregular surfaces are, within limits, desirable to many trail users, including hikers, equestrians, and mountain bikers, as part of a more natural trail experience. In some cases, rocky terrain or frequent tree roots dictate that there will be surface irregularities. In other cases, they can be deliberately retained. Retaining such irregular surfaces may be inappropriate, however, on more heavily used front-country trails, because there are a lot more users and more of them tend to be novices.

Measures

On back-country trails where mountain bikes are accommodated:

1. Where native rock is encountered during construction, a portion of that rock can be retained within the tread (textured or roughened surfaces), provided it does not impede overland sheet flow or present a tripping hazard;
2. The surface is fixed and presents a firm, non-slip surface (not loose, slippery or rolling);

Where equestrians are accommodated, the surface does not present sharp edges that may injure horses' hooves.

Reference

- Modify surface texture by placing rocks in the tread or using an uneven but stable material to control mountain bikers' speeds on trails (IMBA 2007).
- Maintain good sight lines and gradually transition to a change in surface texture or obstacle to allow users to slow down in anticipation (IMBA 2007).
- Unpublished CSP trail design guidelines (see Appendix G)

2.6.8 Low Trail Structures

Low trail structures, such as steps and waterbars, should be avoided on mountain bike and equestrian trails. Mountain bikers and horses have a difficult time negotiating these structures (especially mountain bikers riding uphill), and often ride around them, which can damage the trail or resources along the trail. These structures can be areas where conflicts between users occur. In any case, waterbars are not an effective drainage solution and should be a design solution of last resort.

Measures

Where equestrians or mountain bikes are accommodated:

1. Steps and waterbars are avoided, if possible. They should be design solutions of last resort.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

2.6.9 Gradient

CSP trails are designed for users enjoying the natural resources, and grades should be determined by the land capability, climate, season of use, frequency of use, and canopy cover. Abrupt trail gradient changes cause hard braking by mountain bikers and greater hoof pressure by horses, which impacts the trail tread and could cause a loss of control in the case of bikers, a potential conflict-generating issue. Many of the studies and guidelines identified in the research address maximum gradients as a desirable principle for general multi-use trail design and, in some cases, as a means of controlling mountain bike speed. CSP trail design guidelines and practices do not include specific gradient limits, reflecting highly varied topographic and other site conditions that are the setting for CSP trails, and in response to the policy that the trails will conform to the natural landform and provide an experience of the natural setting.

Measures

Where equestrians or mountain bikes are accommodated:

1. Abrupt gradient changes are avoided. There is a gradual transition from steeper to gentler portions.

Reference

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Build a small rise or minimize grade (10 percent maximum for extended lengths) to slow users at intersections and in locations with poor sight lines such as trail junctions or ridges (East Bay Regional Parks District (EBRPD) 2011; Santa Clara County Parks).
- Avoid abrupt changes in grade and fall line trails, which exacerbate erosion (USFS 2007; Hesselbarth, Vachowski, and Davies 2007).
- Grades should generally be 0 to five percent slope, with a maximum of up to 12 percent, as needed. (City of Portland Parks and Recreation 2009).
- Hikers, mountain bikers, and equestrians can comfortably and safely negotiate different maximum grades on a trail. For an accessible trail, the slope perpendicular to the direction of travel, the cross slope, shall be five percent maximum (CSP Accessibility Section 2005). The USFS *Trail Construction and Maintenance Handbook* recommends slopes of 15 percent or less on climbing turns (Hesselbarth, Vachowski and Davies 2007), while *Trail Planning for California Communities* states that 'wildland trails' should have a 12.5 percent maximum slope (Bondurant, Thompson, et. al. 2009). IMBA uses a maximum of 7 percent side slope grade for climbing turns and cites the 10 percent average guideline for sustainable trails (IMBA 2004).
- The USFS *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* (2007) states that equestrian trails can be as steep as 20 percent grade for no more than 200 feet, otherwise switchbacks should be considered to minimize erosion. On running grades steeper than 5 percent, six to 12 inches of extra tread width should be added as a safety margin where possible (USFS 2007).

- The City of Portland recommends that hiking/mountain biking trails and hiking/equestrian trails should have grades of zero to five percent slope or up to 12 percent, as needed (City of Portland Parks and Recreation 2009). Similarly, California Equestrian Trails and Land Coalition (CETLC) recommends keeping the slope as low as possible (preferably under 12 percent if possible) to allow safe places for passing and visibility (CETLC 2005).
- On running grades steeper than five percent, six to 12 inches of extra tread width should be added as a safety margin where possible (USFS 2007). Also, when trails have outslopes of four to five percent, widening the trail an additional six to 12 inches (152 to 305 millimeters) helps stock stay in the center of the tread (USFS 2007).

2.6.10 Trail Layout and Classification

Trail layout and classification measures do not address trail system layout in detail, a subject that is well covered in the current CSP Trail Handbook and other references. Trail users generally prefer loop trails to "out and back" routes. Bicyclists, and to a lesser extent equestrians, tend to desire longer trail loops than hikers. With equestrians, loop trails are important because a horse can become "barn sour" when retracing a path. When horses know they are heading back to camp or a trailhead, they sometimes get anxious. Knowing that food, water, the company of other horses, and the relief of not carrying riders is close at hand, can cause them to pick up their pace and become difficult to handle, potentially resulting in trail use conflict. This behavior is reduced when riding loop trails.

The context and classification of the trail influences the types and levels of use the trail receives, and these are important considerations for appropriate design and for conflict management. Information on CSP trail classification is provided in Appendix G.

When other public lands and trails connect or are nearby to the CSP unit, the trail's role in the overall regional trail system also needs to be considered. Trails that are a main connection to destinations or that function as connector trails to a series of loops are likely to experience more use than more remote trails. Trails near trailheads experience the highest level of use and a higher level of design may be needed to accommodate multi-use.

These layout and classification considerations are strongly related to options for managing trail use discussed in the Trail Conflict Management Checklist under Separate Trails and Specialized Trails.

<u>Measures</u>

1. The review of the trail use change proposal considers the trail's classification and role in the park unit trail system, and where applicable, the regional trail system. This includes the availability of alternative routes to trails that are otherwise open to the use being studied for addition, and the anticipated level of use.

<u>Reference</u>

Unpublished CSP trail design guidelines (see Appendix G)

Other Relevant References:

- Categorize trails according to a classification system such that trails that are anticipated to accommodate more users have a higher level of design, such as width or passing space, frequency of speed control features, etc. (Forest Service, 2007; Marin Regional Open Space District; East Bay Regional Parks District City of Portland Parks and Recreation and Santa Clara County Parks Department).

- Provide loop trails or an arterial shared-use trail leading to single-use trails (IMBA 2007; Chavez 1996a).

Consider mileage of trails available for each use type when evaluating whether to open or close a trail to a user group. Provide sufficient alternatives to prevent a single trail from becoming overcrowded. **[CSP, Karl had previously suggested that this implied a quota system. Let's discuss]**

2.7 Measures for Trail Use Conflict Management

The Study found that measures for influencing trail user understanding and behavior through information, enforcement, and particularly pro-active communication with trail user groups and individual users, can be as important as physical trail design to address the overall social issue of trail use conflict. The research identified a set of factors and measures that should be considered, as summarized below and detailed in other Study chapters.

The Literature Review and Agency Survey conducted for this Study found that trail use conflict is heavily based on attitudes and perception. Also, the Study found that trail users who don't follow trail rules, courtesies, or common sense often contribute to conflict perception, incidents, and potentially accidents. Similar to the highways and paved trails that are part of transportation systems, "rules of the road" must be established, understood, and generally followed to create an acceptably low-conflict, trail use environment.

The research shows that trail managing agencies and organizations benefit from taking active steps to work with the users to address trail conflict, although the results and opinions are uneven. Conflict management is much more an adaptive process, and subject to local or regional social conditions and history, compared to multi-use trail design. It also tends to be an ongoing process that is highly dependent on available staff resources at a time when resources are increasingly stretched. Nevertheless, conflict management includes an important set of tools to create and maintain multi-use trails that work for the intended users and that conform to CSP policies for trail use.

Using this Checklist requires consideration of the overall trail and trail use setting and the history, nature and relationships of the types of users involved, including specific key individuals.

The overall management principles are important to consider in this Study; specific application details will vary from project to project. The measures are intended to provide a checklist of strategies that can be undertaken to reduce the potential for conflicts on multi-use trails. The greater number of measures in place and implemented, the more likely that conflict will be minimized; however, each situation is unique.

Management measures for reducing trail use conflict are listed below.

2.7.1 Management Strategies

Direct management strategies seek to regulate behavior through sanctions or fines (enforcement) while indirect strategies provide information and education to users to influence behavior. Techniques can be subtle or obtrusive, positive or appealing to a fear of consequence. Management strategies are discussed in this section under the following six categories:

- Rules– adopted and enforceable rules, regarding staying on designated trails, right-of-way, warning when overtaking, speed limits, etc.;
- Enforcement – monitoring, warnings, radar, and citations;
- User information – information about rules, polices, and advice for trail user respect, right-of-way requirements, and courtesy; routes, destinations and conditions;
- Data tracking - collecting and tracking data on trail use conflict incidents and design or management successes;
- Separate trails and specialized trails - alternate use days, one-way trails, and designated use-intensive trails.

Rules

Typical rules include posted speeds, yielding expectations, and where and when users can be on a trail. Park agencies often have the power to cite, give warnings, or exclude users who break rules. If rules are not adopted and posted, they are not enforceable, and if they are not actively enforced, there may be greater difficulty managing user behavior. Rules should be clear, consistent, and fair with regard to the relative potential issues caused by different types of users. People are more willing to comply with rules when they understand the reasons for them. At a minimum, posted rules should include: stay on trails designated for your user type; yield to other users per the "trail right-of-way triangle;" warn when approaching/passing; and comply with the CSP 15-mph speed limit for trails.

<u>Measures:</u>

1. Rules are adopted and posted (see Public Information) with details of the relevant state codes so that they are clear and enforceable (see Enforcement).

<u>Relevant References:</u>

- A 15-mph speed limit can be posted (Santa Clara County Parks Department; CSP Gold Fields District; Jefferson County; Sacramento County); however, challenges to the use of speed limits include difficulty of enforcement, lack of enforcement staff, and users' limited knowledge of the speed they are traveling (Bondurant, Thompson, et. al. 2009; IMBA 2007).
- Focus enforcement at parking lots and use radar guns to enforce speed limits (EBPRD 2011).
- Trail offenders can be sentenced to work service on the trail as part (or all) of their penalty (Flink and Searns 1993).
- Enforce rules consistently to assure users that there is no perception of discrimination among different user groups (Flink and Searns 1993).

User Information

Having enforceable rules is a first step, but effectively communicating them and the reason for the rules is critical to achieving compliance. Relevant information should go beyond rules to include trail courtesy and safety guidelines. This includes information about the characteristics and needs of different user types, and how to behave or prepare to minimize the risk of conflicts and accidents. Examples include shared-trail training and experience for horses and riders, bells and call-out techniques for mountain bikers, and information about routes, destinations and conditions to allow users to make informed choices. Many organizations, including CSP units, have already developed public information materials that can be used and adapted. It is important that the rules and guidelines are consistent with adjacent/connecting lands and trail systems, or that the information clarifies inconsistencies.

Measures

1. Information is available regarding trail use rules and reasons for rules, courtesies, behavior and preparation, and trail designation and condition.
2. The information is posted at major trailheads in detail (e.g., on a mapboard) and summarized on signs.
3. The information is included with printed maps and brochures for the unit.
4. Consistent information is posted on the unit website, and where applicable, on local web sites (e.g., partner or volunteer organizations).

Relevant References

- Interpretation messages are as effective as sanction messages and both types are more effective than no message (Duncan and Martin 2002).
- Cite specific policies with enforceable rules and applicable penalties on signs posted at trailheads, in trail brochures, and on maps (Flink and Searns 1993).
- Maximize efficacy by addressing problem behaviors that are characterized by careless, unskilled, or uninformed actions (Manning 2003).
- Distribute information via multiple media, including brochures, personal messages, audiovisual programs, newspapers, magazines, guidebooks, trained volunteers, outfitters, commercial guides, wilderness ranger and volunteer role modeling, and design information for a variety of target audiences (Manning 2003).
- Connect with or modify visitor attitudes, beliefs, or norms and provide information on the impacts, costs, and consequences of problem behaviors (Anderson, Lime, and Wang 1998; Manning 2003).
- Enforce rules in addition to posting signs (CSP Gold Fields District; Tualatin Hills Parks and Recreation District; Mecklenburg County Park and Recreation; and City of Portland Parks and Recreation).

Enforcement

The presence of rangers or other authority figures on the trail can deter violation of rules and encourage users to follow trail etiquette and use guidelines. Ranger patrols can monitor and track issues; inform, warn and cite users who violate posted rules; and record and respond to comments or complaints from users. Volunteer patrols (see Volunteer Programs) can support all of these enforcement efforts except citations, and in some cases have been found to be a more acceptable and less threatening form of intervention with trail users because they are at more of a peer-to-peer level. In some cases private non-profits are under contract to provide management assistance that may include this role.

Measures

1. Ranger patrol time is allocated for the trail to monitor, inform and enforce compliance with the rules, and encourage awareness and compliance with courtesy, safety and environmental guidelines;
2. An organized volunteer patrol exists or is being formed that will actively support rangers on monitoring and informing trail users.

Relevant References:

- Where speed limits are posted, have rangers enforce speeds, issue citations, or issue warnings to rule breakers (Tualatin Hills Parks and Recreation Department; City of Durango; City of Portland Parks and Recreation; Sacramento County Parks).
- Off-duty police can assist in enforcement (Mecklenburg County; City of Durango).
- Volunteers can assist with patrolling the trail, discussed in the outreach section. Volunteer patrols act as the 'eyes and ears' of a land manager and can enhance visitor experiences, assist land managers, promote trail stewardship, and respond to incidents (IMBA 2007). Volunteer patrols can also model appropriate behavior.

Public Notification and Input

When a trail use change is being considered, or any other major change in trail system conditions or operation is undertaken, it is important to thoroughly notify and involve the users and other interested parties (e.g. other agencies, adjacent property owners, and related businesses) early in the process. This pertains to the formal, project-specific planning and management process, and also to effective ongoing general coordination with the public, as discussed under Outreach and Coordination.

Measures

1. Notice of the proposal and a means and adequate timeframe (e.g. one month) to comment is posted in sources that are likely to reach the interested parties: trailheads, web site(s), local paper, park and local bulletin boards;
2. Notice of the proposal has been emailed to local and statewide user groups and contacts generated by the unit, local press, and adjacent agency contacts, etc.
3. At least one public meeting regarding the proposal has been held/ is scheduled at a time and place that is accessible to most parties, and notes of comments have been/will be created and made available to attendees and points of notification/contact.

Relevant References

- When an agency changes management practices to mitigate conflicts, public dissatisfaction with the decision-making process can be a barrier to implementing management regulations (Front Country Trails Multi-Jurisdictional Task Force – City and County of Santa Barbara, Town of Pagosa Springs).

Collecting and Tracking Data

Data on complaint or incident reports, particularly involving accidents, is valuable to determine how conflict-reduction measures are working. The data is more valuable if specific details are captured (date, time, location, weather, user types, contributing factors, outcomes). The data's usefulness is further enhanced if there are also counts or at least an estimate of trail use to provide a context about relative frequency of occurrence. Based on the scarcity of hard data in the research results, collecting and tracking such data is beyond the abilities of already strained trail management staff. It may be possible to work with volunteers to collect and manage data, but this may raise the issue of bias, if the volunteers are from one type of user or another. Educational institutions or interns may also be used to collect and analyze data. This information can promote user trust in management, thereby lowering perceptions of conflict. Ideally, data would be collected on an ongoing basis; however, collecting data before and after a major trail use change would be a higher priority.

Measures

1. Trail use and incident/accident data is collected, maintained and analyzed in an organized system, as feasible.
2. Volunteers or partners are assisting with data collection and management
3. The data is being collected and analyzed on a short-term project basis in association with the trail proposal;
4. The data is being collected and analyzed on an ongoing basis.

Relevant References

- To effectively deter noncompliant behavior, gather incident and complaint data, use estimates, and user surveys to address the reason(s) behind the behavior and not just the symptoms (Anderson, Lime, and Wang 1998).

Separate Trails and Specialized Trails

User types can be separated by designating some trails for single-use or primary-use. Some agencies have designated trails that are advertised for a particular use, where other user types are secondary or prohibited. This allows the agency to focus design criteria on accommodating a single or fewer user types, providing more flexibility, and it avoids user conflicts on the specific trail segment(s), at least to the extent that other users comply or are comfortable being secondary.

Alternate days for different user types have been designated on some trail systems, with varying level of success. One-way trails have also been established, although this raises the risks of failure to comply. These solutions are more effective on local or front-country trail systems with a more stable user base, and where agencies have the ability to inform the users in advance of the rules.

Separate trails can also be designated for different users. A shared-use feeder trail can lead to separate loop trails for different users, although having parallel but separate facilities in the same corridor may result in resource protection challenges.

Measures

This part of the Checklist does not include specific measures, as the options and their potential feasibility are very case-specific.

Relevant References:

- Designate a use-intensive trail or area (Chavez 1996a).
- Develop parallel treads in the same trail corridor if land base and/or resource concerns allow (USFS 2007).
- Use restriction management techniques include alternate use days, one-way trails, and designated use-intensive trails (Flink and Searns 1993).
- Consider implementing alternating day access, in which mountain bikers are allowed on the trail one day and hikers on another (Jellum 2007; National Park Service [NPS] 2003; Flink and Searns 1993; Jefferson County Open Space).
- Consider designating one-way trails on which mountain bikers can only ride in one direction at all times or on certain days (Jefferson County Open Space; Flink and Searns 1993).
- Other natural area management strategies have found that visitors accept use limit policies if they feel the resource requires the protection afforded by the policy (McCool and Christensen in Lime et. al. 1996)
- Restricting or prohibiting activities can be highly obtrusive and "lead to a strong sense of 'being managed' on the part of the visitor", which can result in a climate of conflict (Anderson, Lime, and Wang 1998).

Spatial Separation

- A survey of mountain bikers in National Forests nationwide found that the management strategy of providing separate trails for different users "was not regarded as a plausible solution by any of the participants."
- A common strategy to separate users who travel at different speeds is to provide parallel treads in the same trail corridor. While this practice is commonly used to separate pedestrians and equestrians from road bicyclists on a paved trail, the strategy is also employed on fully soft-surface facilities. The City of Henderson (NV) and Town of Pagosa Springs (CO) recommend providing separate, parallel equestrian trails.

Temporal Separation

- Different types of use can be allowed on the single tread at different times of day, days of week, season of the year (Flink and Searns 1993)
- A study in Chilkoot Trail National Historic Site, British Columbia found that a management strategy that excludes snowmobilers every third weekend successfully reduced goal interference while increasing skiers' satisfaction but reducing snowmobilers' (Jackson, Haider, and Elliot 2004).

- Both hikers and bikers supported an every-other-day exclusion policy in the Snoqualmie National Forest, Washington. Equestrians were not allowed on the system. (Jellum 2007)
- An Environmental Study considered alternating days when mountain bikers and equestrians were allowed on the Cactus Forest Trail in Arizona. The discussion of the alternating days scenario noted that, while the potential for conflict would be reduced, "some recreationists may feel constrained, and others may be displaced" which were considered "adverse, short- to long-term, and of negligible to moderate intensity depending on the individual" (NPS 2003).
- A survey conducted in the Jefferson County Open Space trail system west of Denver, Colorado categorized users who did not observe, but perceived a problem ("social values conflict") and those who both observed and perceived a problem ("interpersonal conflict"). The study found that more conflicts were reported about mountain bicyclists than hikers. Mountain bicyclists, hikers, and people who participate in both activities all reported more interpersonal, rather than social value conflicts. The study concludes by recommending separation between mountain bicyclists and hikers, stating that, "When the conflict stems from interpersonal conflict, zoning incompatible users into different locations of the resource is an effective strategy" (Carothers, Vaske, and Donnelly 2001)

2.7.2 Outreach and Coordination Strategies

The research has demonstrated that working with trails and user groups, holding public meetings, and educating the public has often been beneficial in reducing conflicts between users and improving safety. Outreach and coordination involve ongoing staff work with user groups, and ideally user groups working with other user groups, to build understanding and cooperative relationships to encourage compliance and minimize conflicts. These measures apply basic trail and trail use information to project-specific and location-specific communications. User group outreach and coordination can include the following strategies:

- Education – user-specific printed materials and web postings, and/or an active, focused public relations campaigns to educate users about trail use rules and appropriate behavior;
- User group relations – general (rather than project specific) meetings with user groups about trail safety or conflict-related issues, or objectives, such as making, improving and maintaining trails and making the trail experience more enjoyable;
- Volunteer programs – ongoing trail patrol and/or maintenance assistance, specific projects, and help with outreach and education regarding conflict avoidance, safety, and courtesy;
- Events –multi-user social, fun, trail construction or maintenance events (e.g. Trail Education Days).

Education

In addition to the basic information discussed under User Information, agencies can reach out to the general user population and to specific types of users to educate existing and prospective trail users about trail use rules (and reasons for the rules), courtesy and safety guidelines, and other information for safe, fun and environmentally compatible trail use. Such education is often combined with project or user group meetings, events and other activities via websites, advertising, outreach to schools, and other activities. Outreach should ideally involve two-way communications – the public can ask questions and get answers, and comments are collected and are reviewed by managers.

Measures

1. Staff or representatives (volunteers or docents) speak at local events, schools, user group regular meetings or other venues to carry overall CSP or unit messages as well as specific safety and conflict management and environmental compatibility messages.
2. Educational outreach includes collection of comments and consideration by management staff.

Relevant References

- Ranger patrols and/or volunteers should speak directly with trail users about sharing the trail (Lake Norman State Park, Jefferson County Open Space, Turlock Lake, Front Country Trails Multi-Jurisdictional Task Force).
- Target presentations of best practices of trail sharing to user groups (CETLC 2005; Flink and Searns 1993; Santa Barbara).
- Reach out to local schoolchildren through skits and trail events to inform them about appropriate trail etiquette (Conejo Open Space Conservation Agency - COSCA).
- Hold training clinics for equestrians and mountain bikers to teach the horses and riders to meet cyclists in varying situations (CETLC 2005).

User Group Relations

Agencies can work with established user groups to build public support for a trail project or management strategy. Such ongoing contact can build trust and a positive relationship because it goes beyond attendance at an occasional or project-specific meeting where tensions may already be high. These contacts can be venues for venting, initially or even permanently, but this can potentially lead to a better understanding and relationship.

Measures

1. Managers or staff regularly attend user group meetings and/or make informal general contacts on an ongoing basis.
2. Managers or staff regularly attend multi-user trail group meetings such as county trail committees, or have formed their own multi-user group and coordinate with them.
3. Volunteers or docents support staff in this capacity, representing CSP positions and reporting back to staff.

Relevant References

- Collaboration between field staff and the mountain bike and equestrian communities can create a shared sense of resource protection and stewardship between staff and user communities (EBRPD 2011).
- Create a trails committee or stakeholder group of individual trail users to gather input on the project (IMBA 2007; Chavez 1997; Moore 1994; COSCA, Vancouver-Clark Parks and Recreation Department VCPRD, Gold Fields, Bureau of Reclamation Lower Colorado Region, City of Henderson).

- Hold joint trail construction or maintenance projects and skills workshops among different users (Moore 1994).
- Hold public meetings, issues identification workshops, community design workshops, public hearings, citizen advisory committees, surveys, and mass media outreach (Moore 1994).
- Collaborate with trail groups to plan, construct, and manage trail projects (VCPRD, Oregon State Parks and Recreation, Front Country Trails Multi-Jurisdictional Task Force, Town of Crested Butte, Mecklenburg County, City of Durango, and Oregon Parks and Recreation).
- Designate a staff member to attend user group meetings and to work with particular groups on trail work days (CSP Gold Fields District).
- Maintain regular communication with different user groups and bring issues to them as necessary (Mecklenburg County, City of Durango).
- Discuss problems with affected user groups via land manager trail walks (Moore 1994).

Volunteer Programs

Agencies can work with or even form volunteer groups to maintain or patrol trails and to encourage and exhibit proper trail etiquette. This can include volunteer trail patrol to assist with monitoring and informing users about rules, courtesies and desirable practices. Working with and especially forming a volunteer group has significant time requirements. There are complex procedural, legal, and safety/liability concerns that go beyond the scope of this discussion. However, where feasible, and in favorable circumstances, volunteer groups can be tremendous resources for addressing trail safety and conflict, as well as assisting with construction and maintenance. Ideally, volunteer groups include members from all user types. Volunteer groups from a single user type are most effective working with their own peer groups. Concerns about potential bias may arise from other groups

Measures

1. Volunteer group(s) exists that take an active role in working with the CSP unit and their respective user type (indicate user groups represented).
2. A multi-user volunteer group with balanced representation from types of users exists and actively helps CSP staff to work with trail users.
3. A multi-user volunteer trail patrol with balanced representation from types of users exists and actively supports CSP staff and works with trail users.

Relevant References

- Messages from other mountain bikers are more effective in changing mountain bikers' behavior than those coming from a uniformed agency volunteer or a hiker (Hendricks et. al. 2001).
- Organize volunteer patrols or 'Trail Watch' groups to remind users of proper etiquette, model good behavior, and assist trail users with questions (IMBA 2007; CSP Gold Fields District; Jefferson County Open Space; Tualatin Hills Parks and Recreation District; CRD Parks; City of Henderson).
- Have volunteers assist with events such as trail maintenance days and Share the Trail events (Flink and Searns 1993; Bondurant, et. al. 2009).

Trail Events

Agencies can organize or facilitate public events supporting local trails, such as trail construction, repair, or maintenance work days, or events that are simply intended to be fun and social and to allow different user groups to come together in a controlled and cooperative way. These events can improve relationships and consideration between trail user groups and with CSP staff, and are opportunities to convey messages about how to avoid trail use conflict.

Measures

1. The CSP unit participates in trail events and provides information and presentation on appropriate trail use as part of their participation in the events.

Relevant References

- Hold "Trail Education Days" for students (COSCA).
- Organize trail work days that include all types of users (Moore 1994; CSP Gold Fields District).
- Encourage user groups to hold 'carrot rides' or 'Romp N' Stomp' events in which mountain bikers feed carrots to equestrians' horses (CSP Santa Cruz District; Moore 1994; IMBA 2007) or bell give-aways (City of San Luis Obispo).

Chapter 3. Research Results

This chapter presents the combined results of the Literature Review and the Agency Survey regarding the nature of trail use conflict and potential solutions. It summarizes the responses without drawing conclusions as to their applicability to California State Parks (CSP) trails, which is accomplished in the Summary Findings in Chapter 1, and the Recommendations in Chapter 2. More detailed results of the Literature Review are presented in Appendix B, and more detailed results of the Agency Survey are presented in Appendix C.

3.1 Introduction

The existing literature and the information provided in the survey responses primarily consist of the opinion of trail system managers and users. Even peer-reviewed academic or U. S. Forest Service (USFS) publications primarily rely on manager and user surveys. Few sources have used detailed data, such as complaint or incident reports, as a basis for analyzing the nature and extent of trail use conflict issues. While there is a wealth of documents and articles on the topic of user conflicts on multi-use trails, the majority of the literature does not provide empirical data regarding the presence, extent, or attributes of user conflict or incidents. While 63 of the 80 Literature Review sources define the problem of trail user conflicts, several of them do so as a presupposition based on previous literature (14 sources), or the author's experience (13 sources). Several sources present surveys on managers' perceptions of conflict (9 sources) or users' perceptions of conflict (22 sources). None of these surveys asked the frequency of actual trail use conflict-related incidents or accidents. This notable lack of citations regarding specific incidents and accidents implies that they occur infrequently.

Documentation of design challenges and solutions is also primarily based on opinion, and does not reflect empirical study or evaluation of success. However, there is a large body of practical experience and informed opinion represented in the research results, and this reflects the "state-of-the-art" in multi-use trail design and management with respect to trail use conflict.

In the following summary, where a theme was cited by a single source, or multiple agency or document sources, the reference follows. Where jurisdictions are cited without a date, the source is that jurisdiction's Agency Survey. If several sources supported the finding, the text provides general reference to support without specifically identifying all documents or agencies. These findings and the supporting documentation are presented in more detail in the Literature Review and Agency Survey presented in Appendices B and C of this Trail Use Conflict Study.

3.2 The Nature of Trail Use Conflict

The literature reviewed and agencies surveyed strongly supported the idea that conflicts between trail users are highly influenced by perception, attitude, and behavior.

U.S. Forest Service (USFS) Lake Tahoe Basin Management Unit staff noted that use conflicts are "very subjective and determined by individuals." Three agencies noted entrenched negative perceptions of other user groups arising from a history of conflict or disagreement; CSP Gold Fields District, the Front Country

Trails Multi-Jurisdictional Task Force, and Jefferson County Open Space all cited historic conflicts contributing to an environment where managers had difficulty addressing root causes of conflict perceptions.

Six percent of the survey respondents noted that the users' purpose of visiting the trail influenced their behavior; conflicts between recreationists and families were mentioned. Less frequent conflicts cited were caused by meet-up groups and running clubs or other users traveling side-by-side and blocking the trail. Comments at the Program Environmental Impact Report (EIR) scoping sessions included concerns that mountain bikers' speeds discourage equestrians and hikers from using the trails.

Conflict is commonly defined as "goal interference attributed to another's behavior," stating that users' dissatisfaction (conflicts) from a perception that other users are preventing them from actualizing their recreational goals (Jacob and Schreyer 1980). They note that this goal interference does not necessarily imply goal incompatibility; users may visit the same trail for similar reasons, despite using different modes.

More recently, Moore (1994) advanced this theory of conflict as interpersonal disagreements, writing that "conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users" (Moore 1994). Watson, a researcher with the USFS, observes that perceptions of conflict are frequently unrelated to measurable incidents of interference in outdoor recreation, but rather reflect an attitude towards wilderness and stereotypes of other user groups (Watson 2001).

Only 2 percent of users surveyed in Boulder County Parks and Open Space reported experiencing conflict on the day of the survey. One-third reported having experienced a conflict at some point in the past. Nevertheless, users reported several complaints, particularly about mountain bikers' speeds, failure to yield, and not communicating when passing (Bauer 2004). In Ohio, State Park managers and district supervisors surveyed reported concerns about mountain bikers' excessive speeds and potential for conflict with other users (Longsdorf 2006).

A 2001 survey of trail users in the Jefferson County Open Space trail system considered the extent to which conflicts between users are interpersonal (based on physical presence of other users) or social values (no contact has to occur). The survey supported the studies, finding that all types of users reported more interpersonal (physical interactions between users) than social values conflicts (Carothers, Vaske, and Donnelly 2001).

Several surveys of trail users have indicated that conflicts between users were highly influenced by perception and orientation. Research conducted in the Bridger-Teton National Forest found that users who had past experience with other trail activities experienced less conflict when encountering participants of those activities than respondents who had never done those activities before. People who had participated in an activity in the past were also more likely to report increased enjoyment due to encounters with that group than were trail users who had never done the activity before, although the relationship was less statistically significant between mountain biking and horse riding (Bradsher 2003).

A survey conducted for the report, *Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand* (referenced in U.S. literature) indicated that pedestrians who had not encountered any bicyclists had more negative perceptions of bicyclists than those who actually encountered them (Cessford 2002). A survey in Wellington Park, Australia found that users had different goals for use of the park;

mountain bikers visited the park for 'socializing' and 'excitement/risk', while other users desired 'relaxation' (Chiu and Kriwoken 2003).

3.3 Primary Types of Conflict

Conflict issues often relate to users' perception of being unsafe, or just annoyed, due to the presence of other types of trail users. Many of the comments received from the Program EIR scoping session stated that conflict is related to mountain bikers failing to yield or passing too quickly. Similarly, common concerns related to user conflicts in both the Literature Review and the Agency Survey include mountain bikers' speeds and lack of warning and/or yielding when passing. Of the 36 surveys returned, the most frequent conflicts noted were between pedestrians/hikers and bicyclists/mountain bikers (68 percent). The second most frequent concern from the Agency Survey was related to conflicts between users with dogs and those without (41 percent). Only 18 percent cited issues between equestrians and mountain bikers, despite this being a prevalent concern in the Program EIR scoping comments.

Six percent noted that users' purpose of visiting the trail impacted their behaviors; conflicts between recreationalists and families also arose. Less frequent conflicts may be caused by meet-up groups, and running clubs, or other users traveling side-by-side and blocking the trail. Comments at the Program EIR scoping sessions included concerns that mountain bikers' speed differential discourages equestrians and hikers from using the trails.

3.4 User-Appropriate Trail Design Strategies

Design can help to minimize the occurrence of incidents, but not eliminate them. Design strategies are defined as physical trail configuration or alignment treatments intended to create a user-appropriate trail experience for designated user types. Incidents are reduced when user-appropriate designs on multi-use trails are implemented.

Design standards tend to feature general solutions that are not primarily directed at minimizing incidents on multi-use trails. Instead they focus on overall user-appropriate design and sustainability, providing dimensions and specifications for multi-use trails as an aggregate of designs for single-use trails. In this context, adequate sight lines, width and/or passing areas, and elements of design that reduce speeds are frequently mentioned in design guidelines for successful multi-use trails. Among agencies that have comprehensive design guidelines, agency staff often cited design elements that were not documented in the standards, but were based on their professional experience and practice.

In both the Literature Review and the Agency Survey, user-appropriate trail design emerged as being critical to minimizing conflict and user-perceived safety concerns on multi-use trails. In *Trails for the 21st Century*, Flink, Olka, and Searns (1993) stress the importance of designing a trail with the users in mind, stating that, "Accommodating a range of users within a single trail depends on trail width, trail surface, and speed of trail users" (Minnesota Department of Natural Resources 2006).

3.4.1 Agency Design Standards and Guidelines

In addition to their own guidelines, agencies surveyed tend to use select state or national guideline documents. The CSP districts primarily use the CSP's *Trail Handbook* (1991), while the USFS and several other agencies refer to the USFS *Trail Construction and Maintenance Notebook*, *FSH2309.18* (USFS 2007). Several agencies also report using the IMBA manual, *Trail Solutions: IMBA's Guide to Building Sweet Single-Track* (IMBA 2004), as well as *Managing Mountain Biking: IMBA's Guide to Providing Great Riding* (IMBA 2007).

3.4.2 Trail Design Strategies

Few documents or agencies provide specific guidance for design measures to address user conflicts, although many documents and agency staff note the significance of the issue and provide general recommendations for solutions. Although multi-use trail design standards vary widely, five design approaches emerged as common themes from the literature review of design standards and survey responses from agencies and organizations that have focused on trail use conflicts on natural surface trails:

- **Adequate Width and Passing Area**– width of the trail tread and cleared space or trail bench to allow users to pass each other, either as a continuous standard, or as passing spaces at defined intervals.
- **Sight Distance** – the length of the trail visible ahead to the user. This is particularly important to resolve in conjunction with speed control features and curvilinear design.
- **Speed Control Features** – including pinch points, trail anchors, technical trail features, 'stiles,' uneven tread surface, and other elements specifically designed to reduce mountain bikers' speeds.
- **Gradient** – limits or variation in the gradient of the trail. This was often referenced as consideration for controlling mountain bikers' speeds.
- **Curvilinear /Sinuous Design** – curving layout of the trail that encourages mountain bikers to slow down, and tends to add to the natural quality and sustainability of the trail.

Figure 3-1 shows the frequency which the Literature Review and Agency Surveys referenced each of these solutions.

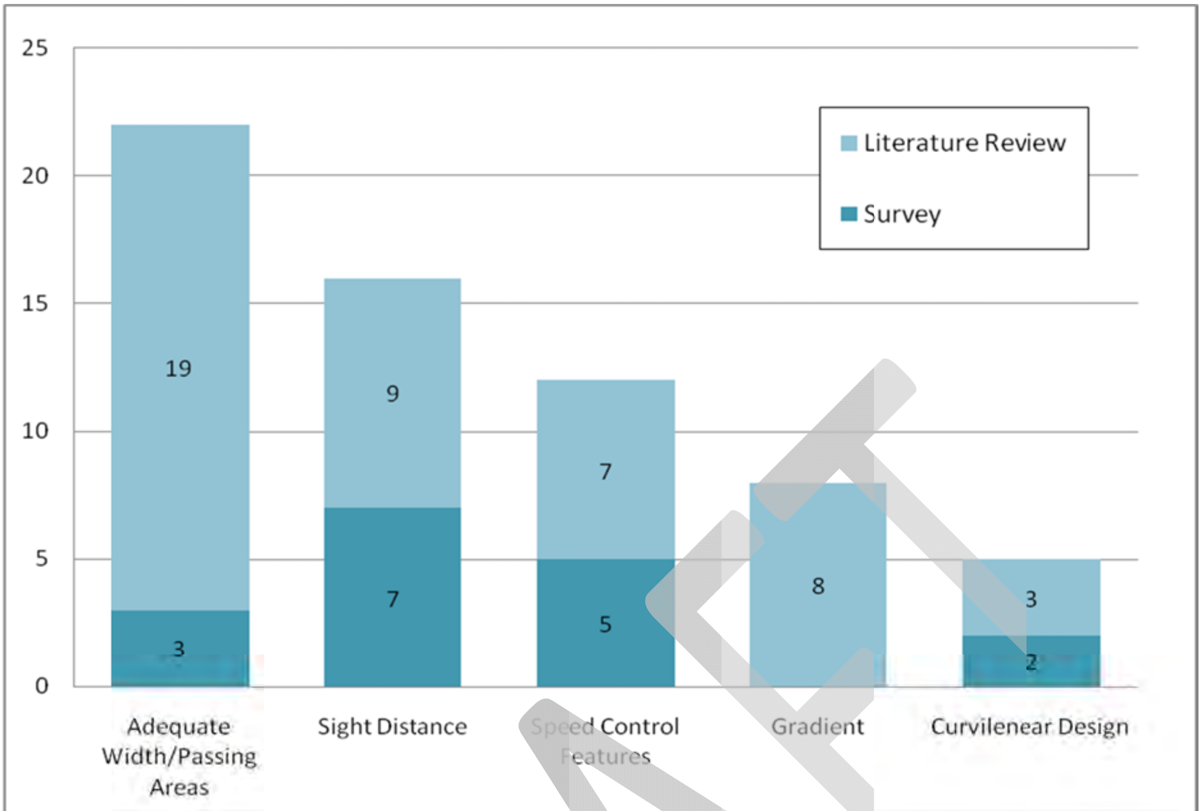


Figure 3-1. Summary of Design Solutions from the Literature Review and Agency Survey

Adequate Width and Passing Space

The width of the trail determines whether users can pass each other easily and safely. It also influences speed; a wide trail may facilitate higher speeds by mountain bikers. Most of the agencies surveyed reported providing sufficient width on trails, without providing specific guidelines.

The *Narrow Natural Surface Trails Study* for the East Bay Regional Parks District (EBPRD 2011) found that, among 15 San Francisco Bay Area parks and open space agencies, the definition of 'narrow natural surface trails' varied from 6 inches to 6 feet wide. Some agencies recommend that trails to accommodate hikers, equestrians, and mountain bikers should be at least 4 feet wide (City of Portland Parks and Recreation, Santa Monica Mountains Area Recreational Trail Coordination Project; Bondurant, Thompson, et. al. 2009) while others recommend a 3-foot minimum (Midpeninsula Regional Open Space District 1993; Minnesota Department of Parks and Recreation, Santa Clara County Parks). The USFS states that hiker- and equestrian-only trails can be as narrow as 1.5 feet wide (USFS 2007; Minnesota Department of Natural Resources 2006). Narrower trail width is part of a suite of speed control elements that are important for safe shared trails (Jellum 2007).

In the literature there is often no clear definition or delineation between the trail tread width and the trail bed widths. These dimensions affect the ability to allow safe passage and provide visible trail space verses the actual space available (including additional shoulders and refuge areas) to allow users to safely pass each other.

Where trails are too narrow for users to pass each other, clear areas or stable shoulders can act as passing areas to reduce conflicts. A passing area or a stable shoulder can be created from a wide bench that is allowed to overgrow (Santa Clara County Parks; City of Portland Parks and Recreation 2009), and a gentle hillslope condition can also provide a safe shoulder area for passing.

Alternately, where the bench or shoulder cannot continuously provide passing space, passing areas may be provided regularly. The USFS recommends passing spaces for equestrians of 5 feet wide by 10 feet long to allow a single trail animal to pull off the tread (USFS 2007). However, there is little guidance regarding the relationship of topography and frequency of use for placement or variance of placement of passing areas. With the lack of specified direction, it is up to the individual trail manager to implement.

Passing space is closely related to sight distance, i.e., the ability to become aware of other trail users in advance. Passing space is also provided where trails are constructed on relatively gentle side slopes (i.e., 20 percent or less), and dense vegetation is removed or cleared.

Sight Distance

Results from the Literature Review, the Agency Survey, and Program EIR scoping comments frequently noted concerns about poor sight lines and blind corners. Specific standards for sight distance were rarely cited in the research and survey, and tended to vary. One hundred feet is the most-frequently cited. The USFS notes that recommended sight distances for equestrians vary and are most commonly 50 to 100 feet (USFS 2007). A 100-foot average sight distance is recommended on trails by three sources (Santa Clara County Parks Department; Flink, Olka, and Searns 1993; Midpeninsula Regional Open Space District 1993), Several agencies address sight line issues with a policy of regularly thinning overgrowth, especially near curves (Wade County Parks and Recreation; Front Country Trails Multi-Jurisdictional Task Force). Sight distance is strongly related to speed controls; if user speed is reduced, the effectiveness of the sight distance is increased.

Speed Control Features

A number of references and surveys recommended placing or using elements along the trail corridor to create narrowing and turns that encourage users to slow down as they approach. These elements have a wide variety of designs and names including:

- 'Speed chokes' (Wake County Parks, Recreation and Open Space).
- 'Technical trail features' (Lake Tahoe Basin Management Unit).
- Pinch points (CSP Santa Cruz District; IMBA 2007) or stiles (Goldstein 1987).

While agencies commonly use these measures for controlling speed, few design guidelines or manuals provide specific instructions for their use. None of the agencies that discussed speed reduction strategies had specific design guidelines or guidelines that defined minimum width, radii, sight lines, or other factors. Several references and agencies state that, if properly installed and well-maintained, these features can create a lower-conflict and safer trail environment. Several agencies (both those that mentioned using design to reduce speeds and those that did not) cited the IMBA manuals (2004 and 2007), which detail the use of obstacles and choke points.

Goldstein cites a personal interview with a ranger, who recommends that the pinch point be the width of the average set of bicycle cranks, plus 2 or 3 inches (Goldstein 1987). He also recommends avoiding 'stiles,' or offset barriers that users have to negotiate, where wheelchair access is an issue.

In *Managing Mountain Biking*, IMBA recommends adjusting the trail 'flow' with anchors, turns, choke points, and surface textures to control speeds (2007). Sufficient sight distance for users is required to see the obstacle and slow down in advance of the feature, although the document does not recommend specific distances.

Surface Texture

As previously noted, IMBA recommends modifying surface texture to control mountain bikers' speeds on trails. IMBA notes that a variety of textures created with rocks, roots, and other uneven material is a desirable challenge for mountain bikers and requires that they slow down to maneuver through the area. Chiu and Kriwoken (2003) similarly recommend "leaving obstacles and rough surfaces to slow users down." A technique for creating this texture is to place rocks in the trail tread. Sightlines and a gradual transition are keys to using this technique.

In addition, IMBA notes that loose soils are more difficult to brake on, and bicyclists may appear out of control when stopping on a loose surface.

Gradient

Trails can be constructed with a grade change so that users approach a ridge nose (where sightlines are poor) or a trail intersection at a gentle or reduced uphill in either direction, slowing users at potential conflict areas (Santa Clara County Parks; EBRPD 2011).

These techniques can enhance the trail experience for all users by varying sightlines and terrain, and they are a key element of sustainable trails to minimize drainage and erosion (EBPRD 2011; IMBA 2007; Parker 2004). Abrupt changes in grade should be avoided, as should fall line trails, which exacerbate erosion.

Sinuous Layout

Several references state that multi-use trails should be designed with curves to follow the natural topography, reduce users' speeds and to create a more varied and enjoyable trail experience. Sinuous design refers to trails that emphasize curves and minimize straight segments. The turns help slow users and add interest to the trail in terms of varied route and views. This can be created by following the natural contour of the land and gaining or losing elevation by crossing contour line obliquely, by the use of trail anchors and pinch points, as previously discussed, or by weaving the trail between trees and other features. Jefferson County Open Space uses 'chicane-style traffic calming' to reduce speeds on soft-surface trails. And as discussed above (see 'Speed Control Features'), IMBA recommends adjusting the trail 'flow' with anchors, turns, choke points, and surface textures to control speeds (2007).

Turns should not be sudden or too tight for users to safely negotiate, and adequate sight distances must be provided. The USFS notes that horses can comfortably negotiate a minimum turn radius of 5 feet, with 6 to 8 feet preferred (2007).

3.4.3 Other Design Considerations

The five principles outlined above are the primary aspects of design to address trail use conflict that were mentioned in the research. Other considerations were also mentioned that are pertinent because of their overall relationship to trail design.

Additional measures were often mentioned involving separate trails for different user groups, or designated use-intensive trails.

Trail Context: Trail Use Levels, Classifications, and Route Alternatives

Trail context was another commonly mentioned consideration for addressing trail use conflict. Trails that accommodate higher frequency of use and/or a large mix of uses (e.g., many mountain bikers and equestrians, rather than mostly equestrians with a few mountain bikers) may generate more complaints than less-used trails. Other factors that affect the extent of conflict on a trail include whether the trail is a main connection destination, desirable loop or a remote trail, and whether there are many opportunities for each trail user group, or few. The level of use on the trail, its importance as a connection to other trails, and the availability of alternative routes are important considerations for its design.

Several agencies establish design standards for width and passing areas on paved paths based on anticipated use by using a hierarchical classification system. However, few agencies define varying standards for natural surface trails based on anticipated use, user types, or context (Marin Regional Open Space District, EBPRD, City of Portland Parks and Recreation, and Santa Clara County Parks). CSP defines trails as Class I, II, or III based on accessibility, interpretive opportunities, distance to visitor use facilities, parking, dead end, and safety factors. A separate classification system is provided for mountain bike trails, which considers aggressiveness, scenic value, length, environmental conditions, staff-determined use, and other factors.

The CSP *Trail Handbook* (1991) notes that, "Placing trails into class categories allows a manager to objectively assign standards and work priorities to trails which are consistent with their primary function, environmental sensitivity, relationship to developed facilities and visitor use."

Some agencies address these contributing factors by classifying trails within the system as major or minor and define differing design standards based on the classification. The implication is that the context of the trail, including the amount and type of existing and likely use(s), access to trailheads, and availability of alternative trails for users, is an important consideration when determining whether it is appropriate to change a designated use.

3.5 Trail Use Conflict Solutions

Common themes and strategies for addressing trail use conflict emerged from the Literature Review and Agency Survey. These include Management Strategies and Outreach and Coordination Strategies. The research indicates that management, outreach and public information is critical to successfully managing conflict, although there is a wide variation in the approach and reported success of these efforts.

3.5.1 Management Strategies

Trail agencies work directly with users or the public to inform users of the rules, encourage them to follow the rules, and cite them if they break the rules. Direct management strategies rely on regulation of behavior through sanctions or fines while indirect strategies provide information and education to users. Techniques can be subtle or obtrusive, positive, or appealing to a fear of consequence. Management strategies have been classified into the following five groups:

- User information – alternate routes and destinations; regulations, guidelines, advice, safety and courtesy.
- Enforcement – radar, warnings and citations.
- Rules and regulations – right-of-way, warning when overtaking, speed limits.
- Public notification – notification of a project or issue, typically with a point of contact and a venting opportunity such as comment cards or a web form.
- Collecting and tracking data on problems and successes.
- Use restrictions - alternate use days, one-way trails, and designated use-intensive trails.

Figure 3-2 shows the frequency that the Literature Review and Agency Survey noted for each of these management strategies.

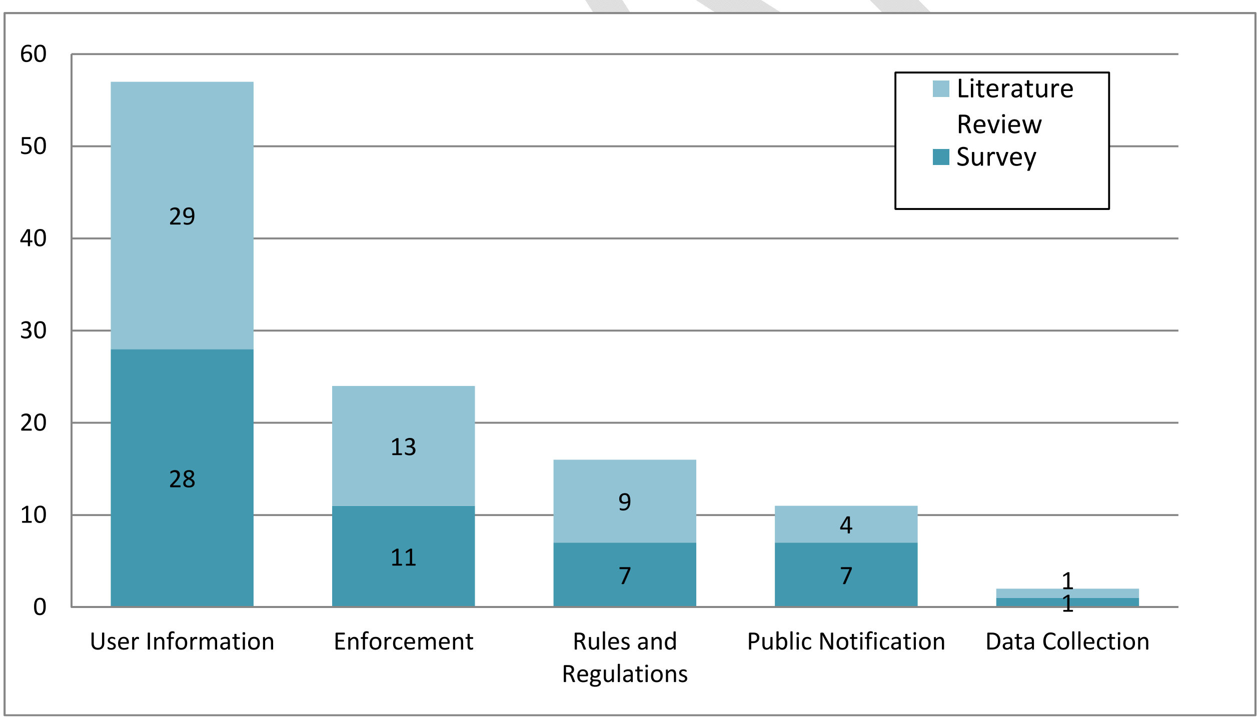


Figure 3-2. Summary of Management Solutions from the Literature Review and Agency Survey

Several of the agencies reported that they had successfully reduced conflicts by prohibiting certain user types. Few of these jurisdictions have a systematic way of determining where certain user types cannot safely share the trail. Unresolvable health, safety, or natural resource issues often rationalize the decision (Oregon Parks and Recreation), although these are seldom defined. These are not discussed in greater detail in the Assessment, as exclusion is not considered a way of accommodating multiple uses on a trail.

User Information

Most jurisdictions post trail courtesy and rules signage such as the yielding triangle, or trailhead instructions for how to behave around horses or mountain bikes. However, there is significant disagreement about how much of an impact posting trail etiquette has on users' behaviors. Several agencies surveyed responded that signs on their own were insufficient (CSP Gold Fields District; Tualatin Hills Parks and Recreation District; Mecklenburg County Park and Recreation; and City of Portland Parks and Recreation) or that only users who are already law-abiding pay attention to signs (Hill County Conservancy).

To increase their impact, signs should cite specific policies with enforceable regulations, or they may recommend yielding or other good behavior. These regulations, as well as why and how the regulations will be enforced and what the applicable penalties are, can be posted at trailheads and included in trail brochures and on maps (Flink and Searns 1993). This information should be distributed via multiple media, including brochures, personal messages, audiovisual programs, newspapers, magazines, guidebooks, trained volunteers, outfitters, commercial guides, wilderness ranger and volunteer role modeling and should be designed for a variety of target audiences (Manning 2003).

Signs are more effective if they appeal to attitudes and beliefs visitors already hold, instead of trying to instill new beliefs. A collaborative effort to improve the trail system in and surrounding the Santa Monica Mountains National Recreation Area concluded that it is essential to post signs at the appropriate location and directed to the group it is communicating information to (Santa Monica Mountains National Recreation Area 1997). To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just symptoms (Anderson, Lime, and Wang 1998; Manning 2003). Interpretation messages have been found to be as effective as sanction messages and both types are more effective than no message (Duncan and Martin 2002).Rules

Speed limits rules are important tools for managing the potential for trail use conflicts. While posted speed limits on trails tend to be used on paved multi-use trails, several agencies reported using speed limits on natural surface facilities. Speed limits posted by agencies surveyed are consistently 15 mph (Santa Clara County Parks; CSP Gold Fields District; Jefferson County; Sacramento County).

Challenges to the use of speed limits include difficulty of enforcement, lack of enforcement staff, and users' limited knowledge of the speed they are traveling (Bondurant, Thompson, et. al. 2009; IMBA 2007).

Agencies interviewed in the EBRPD *Narrow Natural Surface Trails Study* generally felt that focusing enforcement at parking lots and using radar guns to enforce speed limits were successful strategies (EBPRD 2011). Park agencies often have the power to cite, give warnings, or exclude users who break rules. Agencies surveyed seldom used this authority (CSP Gold Fields District; Oregon Parks and Recreation; Tualatin Hills Parks and Recreation District; Hill County Conservancy). One way of engaging trail users who break rules is to consider sentencing trail offenders to work service on the trail as part (or all) of their penalty (Flink and Searns 1993).

Rules should be enforced consistently to assure users that there is no perception of discrimination among different user groups (Flink and Searns 1993). Flink and Searns also note that signs are more effective if they address attitudes and beliefs visitors already hold and provide information about the rationale for the regulation.

Enforcement

The presence of rangers or other authority figures on the trail can deter undesired activities and encourage users to employ trail etiquette. Ranger patrols can warn or cite users who violate posted regulations and record and respond to comments or complaints from users. Where speed limits are posted, rangers can enforce speeds or issue citations or warnings to rule breakers (Tualatin Hills Parks and Recreation Department; City of Durango; City of Portland Parks and Recreation; Sacramento County). Off-duty police can assist in enforcement (Mecklenburg County; City of Durango).

Volunteers can also assist with patrolling the trail, discussed in the outreach section. Volunteer patrols act as the 'eyes and ears' of a land manager and can enhance visitor experiences, assist land managers, promote trail stewardship, and respond to incidents (IMBA 2007). Volunteer patrols can also model appropriate behavior.

Public Notification

Because user conflict is driven by users' perceptions, it is crucial for agencies to include public discussion and feedback when they are considering new or modified management to reduce conflicts. Public dissatisfaction with the decision-making process can be a barrier to implementing management regulations (Santa Barbara, Town of Pagosa Springs). While it is likely that most agencies alert the public when making planning or policy decisions, and many sources mentioned working with the public more extensively, they did not provide specific details of public notification practices. General strategies regarding coordination with the public are provided in the section on Outreach and Coordination below.

Collecting and Tracking Data

Data about the frequency or rate of incidents promotes user trust in management and reduces perceptions of conflict. This Assessment has found that relatively few incidents on trails occur, particularly when compared to the amount of trail use.

Few of the agencies surveyed collect or retain incident or complaint data, and only three of the Literature Review sources based their analyses of the nature or significance of conflict between users on incident or complaint data. Jefferson County Open Space is currently tracking public responses to alternate day and one-way management strategies they implemented on a trial basis.

To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just actions (Anderson, Lime, and Wang 1998). To do this, Anderson, Lime, and Wang recommend gathering and evaluating incident and complaint data, use estimates, and user surveys.

Use Restrictions

Use restriction management techniques were frequently mentioned, including alternate use days, one-way trails, and designated use-intensive trails (Flink and Searns 1993).

These strategies are likely to be particularly successful in a setting where the majority of users are local residents who return to the trails, such as state parks that are adjacent to metropolitan areas. However, they may be impractical in a setting where the users come from a wide geographic area and cannot be kept informed in advance of the rules.

Alternating Days

Some park agencies instituted alternating day access, in which mountain bikers are allowed on the trail one day and hikers on another day, or one-way trails on which mountain bikers can only ride in one direction at all time or on certain days (Jefferson County Open Space; Flink and Searns 1993). Jefferson County Open Space staff reports that the alternate use was a successful management response, although other jurisdictions have had difficulty managing and enforcing these regulations. Both hikers and bikers supported an every-other-day exclusion policy in Washington State (Jellum 2007), although an Environmental Assessment in Arizona found the displacement associated with an alternating days strategy to be adverse, if only moderately to negligibly so (National Park Service 2003).

One-Way Trails

Jefferson County Open Space also implements directional trails for one-way travel by mountain bikers. One-way trails are also potentially problematic due to the need to inform users in advance, and the higher risk caused by failure to comply when it is expected by other users, and is rather a "no prospect" alternative.

Single-direction trails can alleviate congestion, provide a more predictable experience, and reduce the number of passes between users. Direction restrictions may be combined with user restrictions (such as on a mountain bike-only trail), applied to only one type of user, or applied at certain times or days (IMBA 2004).

3.5.2 Outreach and Coordination Strategies

Several agencies responded that working with trails groups, holding public meetings and educating the public had the greatest effect on reducing conflicts between users. Outreach and coordination are strategies wherein staff works with user groups, and ideally user groups work with other user groups, to build understanding and cooperative relationships to minimize conflicts. Agencies are increasingly using these types of "bridge building management styles" to engage users and build communities (Chavez 1996b). Chavez notes that, "the increasing use of this [bridge building] strategy often accompanies decreasing budget allocations."

User group outreach and coordination can include the following strategies:

- Education – user-specific printed materials and web postings, and/or an active, focused public relations campaign to educate users about trail use rules and appropriate behavior;
- Meetings with user groups – including general meetings about specific conflict-related issues or objectives.
- Volunteer programs – ongoing trail patrol and/or maintenance assistance, specific projects, outreach and education regarding conflict avoidance, safety, and courtesy;
- User group notification - of a project or issue with a point of contact and venting opportunity such as comment cards or a web form.
- Events –multi-user social, fun, trail construction or maintenance events (e.g. Trail Education Days).

Figure 3-3 shows the frequency of references to outreach and coordination strategies in the Literature Review and the Agency Survey.

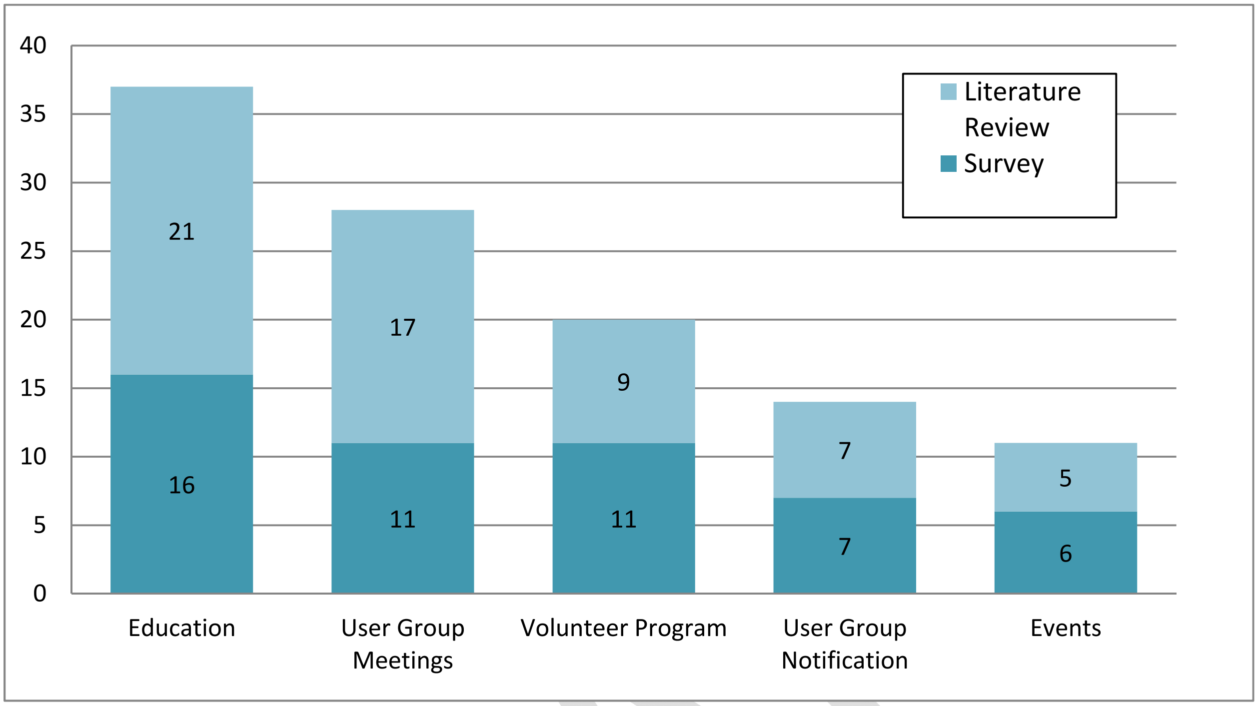


Figure 3-3. Summary of Outreach and Coordination Solutions from the Literature Review and Agency Survey

Education

Many of the agencies who have ranger patrols or who work with volunteers reach out to users through those avenues. Some agencies specifically cited speaking with trail users about sharing the trail as a successful strategy (Lake Norman State Park, Jefferson County Open Space, Turlock Lake, Front Country Trails Multi-Jurisdictional Task Force). Turlock Lake SRA staff noted that education informing users the spirit of trail development and the agency's goal and mission is most effective. In Santa Barbara, staff from the three jurisdictions that are part of Front Country Trails Multi-Jurisdictional Task Force presented best practices of trail sharing, which "helps put the complaints of certain members into perspective."

Conejo Open Space Conservation Agency (COSCA) teaches trail etiquette to local schoolchildren through skits performed at the annual "Trails Education Days." They previously gave out key chains with the yellow etiquette symbol at public events but discontinued that practice due to budget cuts.

Similar to trail user etiquette signs discussed under management strategies, brochures and other outreach methods can be used to inform trail users of expectations and to be aware of other users. Flink and Searns recommend that "if mountain bikers will be using your trail, you should develop an educational campaign on proper trail use for all users" (Flink and Searns 1993).

The California Equestrian Trails and Land Coalition (CETLC) recommends that agencies and user groups educate users about the "startle factor" of horses (CETLC 2005), both for equestrians to be aware of mountain bikers potentially spooking the horse and for other users about how to act around horses. They recommend holding training clinics for equestrians to teach the horses and riders to meet cyclists in varying situations.

User Group Meetings

Many of the agencies reported working with established user groups to be a successful or necessary strategy. CSP Gold Fields District designates a staff member to attend user group meetings and to work with particular groups on trail work days. Mecklenburg County and the City of Durango recommend maintaining regular communication with different user groups and bringing issues to them as necessary.

Several agencies collaborate with trail groups to plan, construct, and manage trail projects (Vancouver-Clark Parks and Recreation Department [VCPRD], Town of Crested Butte, Mecklenburg County, City of Durango, and Oregon Parks and Recreation).In some cases, agencies reached out to individual trail users independent of user organizations. This type of collaboration can be formalized through a trails committee (COSCA, VCPRD, CSP Gold Fields District) or via open houses. Several agencies hold stakeholder meetings to discuss solutions to user conflicts (Bureau of Reclamation Lower Colorado Region, Henderson), while others hold multi-user trail meetings when developing plans (Oregon State Parks and Recreation and Front Country Trails Multi-Jurisdictional Task Force).Trail Advisory Groups can help identify and solve user conflicts before they become serious problems (IMBA 2007).

EBPRD found that in some cases, collaboration between field staff and the mountain bike and equestrian communities successfully created a shared sense of resource protection and stewardship between staff and bicyclists enthusiasts (EBRPD 2011).

Volunteer Programs

Several agencies work with volunteers to maintain or patrol trails or to encourage and exhibit proper trail etiquette. Volunteer patrols remind users of proper etiquette, model good behavior, and assist trail users with questions (CSP Gold Fields District; Jefferson County Open Space, Tualatin Hills Parks and Recreation District, CRD Parks, City of Henderson). Trail Watch programs can be successful, as they provide a sense of ownership and provide “eyes on the trail” (City of Henderson).

Volunteers can help with several aspects of trail management. They can reach out to other trail users and educate or appeal to them to yield to other users, and they can assist with events such as trail maintenance days and Share the Trail events (Flink and Searns 1993; Bondurant, et. al. 2009).

IMBA highly recommends such programs, stating that volunteer patrols are a “tangible reminder that mountain bikers are aware of their potential effect on other visitors, are committed to regulating themselves, and are willing to give back to the trails in the form of volunteerism” (IMBA 2007). A study conducted on Marin County’s popular Mt. Tamalpais found that messages from other mountain bikers were more effective than those coming from a uniformed agency volunteer or a hiker (Hendricks et. al. 2001).

User Group Notification

Similarly to meetings with user groups, notifying groups when beginning a planning effort encourages users to be involved and invested in decisions. While several sources mentioned working with users in planning efforts, they did not provide specific information on the topic, but it is assumed to be a standard practice among agencies who work with user groups.

Trail Events

Agencies can organize or facilitate events that allow different user groups to combine in a controlled, cooperative way, such as trail construction, repair, or maintenance work days; competitions such as triathlons and adventure course events that combine kayaking and/or swimming with trail activities, or events that are simply intended to be fun and social.

Agencies and user groups hold a variety of events on trails, including events with specific 'Share the Trail' messages and more general trail clean-up or maintenance days. Events include "Trail Education Days" for 5th graders (COSCA), trail work days that include all types of users (CSP Gold Fields District; Moore 1994), 'carrot rides' or 'Romp N' Stomp' events in which mountain bikers feed carrots to equestrians' horses (CSP Santa Cruz; Moore 1994; IMBA 2007), bell give-aways (City of San Luis Obispo). Specific staff can be assigned to work with various user groups on trail work days (CSP Gold Fields District).

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Chapter 4. Bibliography

This chapter provides a list of the references cited in chapters 1, 2 and 3.

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Appendix A. Recommendations Incorporation in Process Documents

This Appendix illustrates how the two checklists recommended to address trail use conflict on multi-use trails could be incorporated into the CSP Trail Use Change Process documents – the existing checklist used to evaluate the feasibility of trail use change and to the associated forms. Specific recommended changes to the forms and process are illustrated below:

Note: Because trail use conflict is primarily a social/perceptual issue, and is rarely evidenced by significant safety issues related to accidents between user types, inability to meet conflict-reducing measures does not mean the trail use change is not feasible or that it has a significant impact under CEQA. Thus completing the trail use conflict checklists are on a side track from the process that directly results in the determination of project feasibility.

The Trail Use Change Survey preparers or CEQA preparers could find that there is a significant case-specific safety issue related to trail use conflict.

Figure A-1 illustrates where the checklists fit into the current process.

Evaluation and Trail Log

The *Trail Log* notes the physical conditions and requirements for the use in question to be added (or in some cases continue) on the road or trail. The checklist for design to address trail use conflict/use-appropriate design (see Table A-1) should be applied at this stage.

The evaluation of existing physical conditions and determination of the implications for improvements to add (or keep) the use under consideration should include review of the checklist, with results reflected in the Trail Log.

The evaluator will need to use judgment about which conflict-reduction design measures are necessary and practical. Overall, there are two conclusions the evaluator could make (presumably in consultation with the person who will complete the Survey):

1. The road or trail is designed or can be modified to meet enough of the conflict-reduction design measures to accommodate the proposed use; the necessary conditions and modifications are reflected in the Trail Log.
   OR
2. The road or trail is not designed and/or it is not practical to modify it to meet enough of the conflict-reduction design measures to accommodate the proposed use; the necessary conditions and modifications are reflected in the Trail Log.

In some cases the evaluation may find that conditions and feasible modifications for use-appropriate design do not support an existing use

Trail Use Change Survey

The *Survey* form considers the results of the *Evaluation and Log* in context and makes a finding regarding overall feasibility.

The Survey would be easier to follow if the Evaluation Criteria were referenced numerically to the summary on the first page. This is illustrated in Figure A-2. No other changes to the Survey form are recommended, except that a line has been added under Existing Conditions that notes that the Evaluation and Trail Log has been completed.

The checklist for Trail Use Conflict Management (Table A-2) would be completed in parallel with the Trail Use Change Survey, but it is on a separate track, and is not a direct basis for the decision of feasibility of the use change. It does not relate to the CEQA process but does relate to the existing step prior to the CEQA process to "gather input from local trail user groups or local Trail Advisory Committee". Completion of the checklist should realistically consider the staff resources available to complete or continue the management actions.

Like the physical conditions or changes specific to accommodating specific uses and addressing trail use conflict, the Trail Use Conflict Management Checklist evaluation is not a "make or break" factor in the trail use change decision – but it is an important consideration and part of the ultimate Work Plan.

Work Plan

The Work Plan is the comprehensive implementation plan for the project. The flow chart "Project Implementation" box in Figure A-1 currently states, "Project implementation includes not only trail modifications but also the future plans for any needed enforcement, patrol development and user education program plans."

Completing the Trail Use Conflict Management Checklist will generally identify conditions, accomplishments, and needed actions. As part of the Work Plan, a specific action plan for trail use management and user group outreach and coordination should be prepared, to help minimize conflict and make the trail use change successful.

Figure A-1: Recommendations Integrated into Current Process

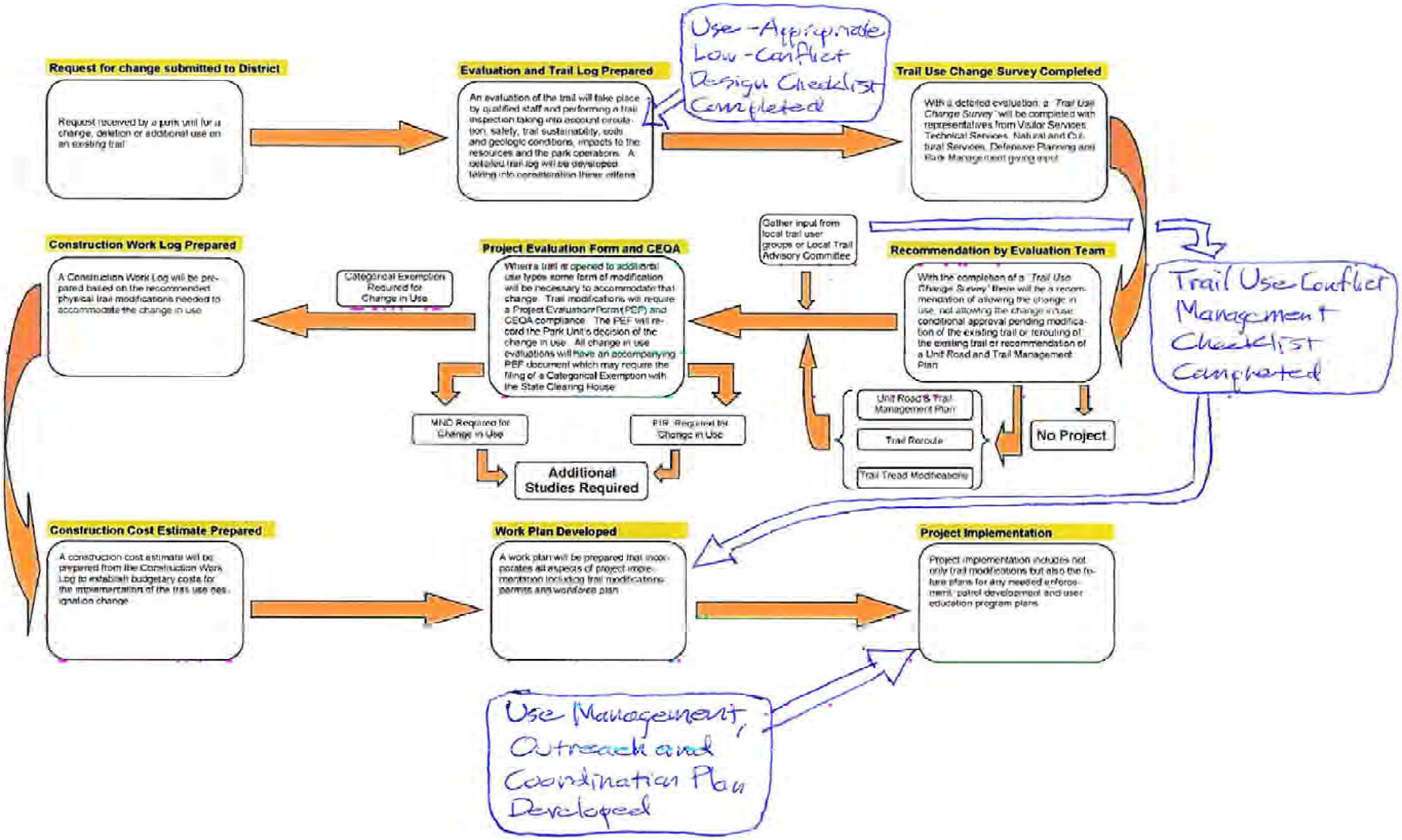

Figure A-2: Recommended Modifications to Trail Use Change Survey

Park (Including Classification):	
Trail Name:	
Location in Unit:	
Current Use Designation(s):	
Proposed Use Type Change:	
Use Change Initiated By:	
Evaluation Date:	

(column added)

Criterion #	Evaluation ~~Criteria~~ Summary	Yes	No	Summary Criteria Evaluation Based on the Synthesis of Data from the Following Pages
1 - Existing Conditions	A Trail evaluation and Log Has Been Completed			
2 - Compatibility	Based on Criteria, is this Use Change Compatible?			
3 - Circulation	Based on Criteria, does this Use Change Enhance Circulation?			
4 - Safety	Based on Criteria, will this Use Change Decrease Trail Safety?			
5 - Sustainability	Based on Criteria, is the Trail Sustainable Under Existing Use Conditions?			
	With the Proposed Use Change Will the Trail be Sustainable			
6 - Natural or Cultural Resources	Based on Criteria, will the Proposed Used Change Create Negative Impacts to the Natural or Cultural Resources?			
7 - Maintenance and Operation	Will the Proposed Use Change and/or Modifications to the Existing Trail Create Significant Facility Maintenance or Operational Work Load?			
8 - Alternatives	Are there other Routes in the Unit or on Nearby Public Lands that Adequately Accommodate the Type of Trail Use Proposed?			
9 - Permits	Would needed modifications trigger outside agency permits?			Insert Map of Area of Proposed Use Change

Recommendation Based on Evaluation Criteria - Substantiate in Comment Box	Yes	No
Recommend that the Park's General Plan or Road and Trail Management Plan be Developed or Amended to Evaluate this Change in Use		
Recommend that the Proposed Change in Trail Use be Approved		
Recommend that the Proposed Change in Trail Use be Approved After Design Modifications are Implemented:		
Recommend that the Major Reroute be Considered to Accommodate Proposed Change in Use		
Recommend that the Proposed Change in Trail Use be Approved with Management Options such as: Alternating Days of Use, One Way Travel, Seasonal Closures etc.		
Recommend that the Proposed Change Use be Put on Hold - See Comment Box Below		

Comments:

Table A-1: Checklist for Low-Conflict Multi-Use Trail Design

Checklist for Use-Appropriate, Low-Conflict Multi-Use Trail Design					
Evaluation Criteria			**Yes**	**No**	**Comments**
Check any existing conditions; note feasibility of modifications to add in comment box:					
1.1	**Tread Width and Passing Space - Front-country Trails**				
	a.	Where mountain bikes are accommodated, but not equestrians: minimum tread width is 30 inches			
	b.	Where equestrians are accommodated: minimum tread width is 48 inches			
	c.	Where hillside slopes are steep, passing spaces are provided at regular intervals (the interval depending on the sight distance available):			
		i. A minimum of 48 inches wide and 60 inches long where mountain bikes are accommodated, but not equestrians			
		ii. A minimum of 60 inches wide and 60 inches long where equestrians are accommodated			
1.2	**Tread Width and Passing Space - Back-country Trails**				
	a.	Where mountain bikes are accommodated, but not equestrians: minimum tread width is 18 inches			
	b.	Where equestrians are accommodated the minimum tread width is 36 inches			
	c.	Where hillside slopes are steep, passing spaces are provided at regular intervals (the interval depending on the sight distance available)			
		i. A minimum of 36 inches wide and 60 inches long where mountain bikes are accommodated, but not equestrians			
		ii. A minimum of 60 inches wide and 60 inches long where equestrians are accommodated			
1.3	**Sight Distance**				
	Where mountain bikes are accommodated:				
	a.	Sight distance of between 80 to 200 feet is provided depending on the percent of slope of the trail gradient (0 to 20%+)			
	b.	Where turns and/or speed control features are in place on a trail segment such that bike speed is controlled below 15 mph, sight distance may be reduced within that segment (but not the portions approaching)			
1.4	**Sinuous Layout**				
	Where mountain bikes are accommodated:				
	a.	The trail avoids long, straight and uninterrupted sight lines (particularly on downhill runs)			
	b.	The trail follows a curvilinear alignment with numerous turns created by contouring around the landform, around trees and rock outcroppings, and dipping in and out of			
	Where equestrians are accommodated, but not mountain bikes, or even on hiking-only trails, sinuosity can be a desirable feature, but is not as high a priority.				
1.5	**Turn Radius**				
	a.	Where mountain bikes are accommodated, but not equestrians:			
		i. Minimum turn radius is four feet for switchbacks, (three feet for climbing turns)			
		ii. Grade of the upper and lower leg of the turn does not exceed 14 percent, unless the material is durable enough to support a steeper grade, but in no case should grade exceed 20 percent			
	b.	Where equestrians are accommodated:			
		i. Minimum turn radius is five feet			
		ii. If the trail is used by pack stock, the minimum radius is six feet			
		iii. The grade of the upper and lower leg of the turn should not exceed 14 percent, unless the parent material is durable enough to support a steeper grade			

Table A-1: Checklist for Low-Conflict Multi-Use Trail Design (page 2)

Evaluation Criteria			Yes	No	Comments
1.6		**Speed Control Features**			
	a.	Where mountain bikes are accommodated:			
		i. Otherwise straight trail sections are modified by using natural features such as trees or rock outcroppings, or relocated natural materials such as rocks or logs, to create curves and turns such that users must make a series of turns to negotiate the section			
		ii. The speed control features are substantial enough in volume that users can easily see them and will not accidentally or deliberately run over them (e.g. 3 to 4 feet high and 4 to 6 feet wide). They are constructed of rocks, logs, or root wads, and may include introduced or naturally occurring native vegetation			
		iii. They may be combined with a soil mound, but do not consist entirely of a soil mound, as this could be used as a jump			
		iiii. They blend into the natural landscape, at least when trail construction and associated vegetation matures			
	b.	Where equestrians and mountain bikes are accommodated:			
		i. As above, plus a horse can easily negotiate the features (turn radius, width, clearance)			
1.7		**Surface Texture**			
	On back-country trails where mountain bikes are accommodated:				
	a.	Where native rock is encountered during construction, a portion of that rock can be retained within the tread (textured or roughened surfaces) if it does not impede overland sheet flow or present a tripping hazard, provided;			
		i. The rock is fixed and presents a firm, non-slip surface (not loose, slippery or rolling)			
		ii. Where equestrians are accommodated, the rock does not present sharp edges that may injure horses' hooves			
1.8		**Structures**			
	Where equestrians or mountain bikes are accommodated:				
	a.	Steps and waterbars are avoided if possible – they should be design solutions of last resort			
1.9		**Gradient**			
	Where equestrians or mountain bikes are accommodated:				
	a.	Abrupt gradient changes are avoided – there is a gradual transition from steeper to gentler portions			
1.10		**Trail Layout and Classification**			
	a.	The review of the trail use change proposal considers the trail's classification and role in the park unit trail system, and where applicable, regional trail system]			
		Recommendation Based on Evaluation Criteria - Substantiate in Comment Box			

Table A-2: Checklist for Trail Use Conflict Management

Checklist for Trail Use Conflict Management					
Check any existing conditions; note feasibility of/commitment to additional measures in comment box:					
Evaluation Criteria			**Yes**	**No**	**Comments**
2.1	**Rules and Regulations**				
	a.	Regulations are adopted and posted (see Public Information) with details of the relevant state codes so that they are clear and enforceable (see Enforcement)			
2.2	**User Information**				
	a.	Information is available regarding trail use rules and reasons for rules, courtesies, behavior and preparation, and trail designation and condition			
	b.	The information is posted at major trailheads in detail (e.g. on mapboard) and summarized on signs			
	c.	The information is included with printed maps and brochures for the unit			
	d.	Consistent information is posted on the unit website, and where applicable, on local web sites (e.g. partner or volunteer organizations)			
2.3	**Enforcement**				
	a.	Ranger patrol time is allocated for the trail to monitor, inform, and enforce compliance with the rules and encourage awareness and compliance with courtesy, safety and environmental guidelines			
	b.	An organized volunteer patrol exists or is being formed that will actively support rangers on monitoring and informing trail users			
2.4	**Public Notification and Input**				
	a.	Notice of the proposal and a means and adequate timeframe (e.g. one month) to comment is posted in sources that are likely to reach the interested parties: trailheads, web site(s), local paper, park and local bulletin boards			
	b.	Notice of the proposal has been emailed to local to statewide user groups and contacts generated by the unit, local press, adjacent agency contacts, etc.			
	c.	time and place that is accessible to most parties, and notes of comments have been/will be created and made available to attendees and points of notification/contact			
2.5	**Collecting and Tracking Data**				
	a.	Trail use and incident/accident data is collected, maintained and analyzed in an organized system, as feasible			
	b.	Volunteers or partners are assisting with data collection and management			
	c.	The data is being collected and analyzed on a short-term project basis in association with the trail proposal			
	d.	The data is being collected and analyzed as an ongoing effort			
2.6	**Education**				
	a.	Staff or representatives (volunteers or docents) speak at local events, schools, user group regular meetings or other venues to carry overall CSP or unit messages as well as specific safety and conflict management and environmental compatibility messages			
	b.	Educational outreach includes collection of comments and consideration by management staff			
2.7	**User Group Relations**				
	a.	Managers or staff regularly attend user group meetings and/or make informal general contacts on an ongoing basis			
	b.	Managers or staff regularly attend multi-user trail group meetings such as county trail committees, or have formed their own multi-user group and coordinate with them			
	c.	Volunteers or docents support staff in this capacity, representing CSP positions and reporting back to staff			
		Recommendation Based on Evaluation Criteria - Substantiate in Comment Box			

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Trail: ______________________________ Date: 11/1/2007

Segment ________________ Park Unit: ______________________________

Feet	Action	Feature	Size/Qty L	H	W	Units	Comment	Total
0		Rail Fence	35			lf		**35**
0		Sign					Interp.	**0**
0								**0**
46		Junction						**0**
46		Bridge	45			lf		**45**
46	Remove	Slough and Berm	19629			lf	to allow water drainage	
46	reconstruct	trail at all drainage crossings and ephemeral or topographical swales					construct armored drainage crossings at all ephemeral and topographical drainages that cross the trail - remove existing at grade wooden drainage crossings and replace with rock structures at such crossings	
46		Rail Fence	12			lf		**12**
444	Const	Pinch Point						**0**
526		Drainage Crossing						**0**
526	Recon	Water Bar					replace 4" with 8"	**0**
526		Retaining Wall Wood	20	2		sq ft		**40**
590	Const	Pinch Point						**0**
590	Haul	Material	580			lf		**580**
766		Bridge	20			lf		**20**
766	Reconst	Bridge				lf		**0**
823	Const	Pinch Point						**0**
1294		Rocky Soil	1294			lf		**1,294**
1412	Reconst	Drainage Crossing						**0**
1420		Material					3 or 4 pp	**0**
1460	Const	Pinch Point						**0**
1677	Const	Pinch Point						**0**
1719		Full Soil	425			lf		**425**
1847	Const	Pinch Point						**0**
1862		Retaining Wall Wood-W	16	2		sq ft		**32**
1953	Const	Pinch Point						**0**
2044		Rocky Soil	325			lf		**325**
2076		Material						**0**
2216	Const	Pinch Point						**0**
2269		Full Soil	225			lf		**225**
2270		Material					Euc Grove, many pp	**0**
2432	Const	Pinch Point						**0**
2500	Const	Pinch Point						**0**
2545	Const	Pinch Point						**0**
2694	Const	Drainage Crossing					In Drainage	**0**
2862		Bridge	20			lf		**20**
2934		Rocky Soil	665			lf		**665**
2974	Const	Pinch Point						**0**
3230	Const	Pinch Point						**0**
3322	Const	Pinch Point						**0**
3404		Junction						**0**
3404		Sign					Directional	**0**
3414	Remove	Water Bar -Wood						**0**

Feet	Action	Feature	Size/Qty			Units	Comment	Total
			L	H	W			
3424		Retaining Wall Wood	25	3		lf		**75**
3484		Slide						**0**
3518	Const	Pinch Point						**0**
3540		Material					down slope	**0**
3663	Const	Pinch Point						**0**
3669		Full Soil	735			lf		**735**
3700		Slide						**0**
3814	Const	Pinch Point						**0**
3814		Material					snag upslope 20'	**0**
3874	Const	Pinch Point						**0**
3919	Const	Pinch Point						**0**
3966		Material					snag, 2 pp	**0**
4235	Recon	Switchback						**0**
4279	Const	Pinch Point						**0**
4366		Material						**0**
4474	Const	Pinch Point						**0**
4594		Rocky Soil	925			lf		**925**
4660		Material						**0**
4780	Const	Pinch Point						**0**
4780		Material						**0**
4850	Const	Pinch Point						**0**
4910	Reconst	SW						**0**
4977	Const	Pinch Point						**0**
5050		Material						**0**
5102		Material						**0**
5270	Const	Pinch Point						**0**
5375		Material						**0**
5429	Const	Pinch Point						**0**
5494		Full Soil profile	900			lf		**900**
5530	Const	Pinch Point						**0**
5564		Rocky Soil profile	70			lf		**70**
5635		Material					upslope	**0**
5649	Const	Drainage Crossing					In Crossing	**0**
5674		Full Soil profile	110			lf		**110**
5700	Const	Pinch Point						**0**
5792	Const	Pinch Point						**0**
5960	Reconst	Switchback						**0**
5989	remove	Limb						**0**
5989		Material					OH limb	**0**
6026		Material						**0**
6115		Material						**0**
6149	Const	Pinch Point						**0**
6189	remove	Rootwad						**0**
6254		Rocky Soil	580			lf	Begin	**580**
6288	Const	Drainage Crossing						**0**
6354	Const	Pinch Point						**0**
6435		Material					upslope	**0**
6508	Const	Pinch Point						**0**
6571	Const	Pinch Point						**0**
6650	Const	Pinch Point						**0**
6721	Const	Pinch Point						**0**
6771		Material					down slope	**0**

Appendix B. Literature Review

This appendix presents the methodology and detailed results of the Literature Review conducted for the Trail Use Conflict Study. It reviews the content and quality of the available literature on the subject of trail conflict conditions, issues, impacts, and potential solutions on natural surface multi-use trails. The first section presents the methodology used to identify and critique the studies reviewed. The second section discusses potential solutions identified in the Literature Review, some of which are incorporated into the recommendations presented in Chapter 2 where they are applicable to California State Parks. The appendix closes with a brief review and critique of the key resources identified through the review. An annotated bibliography, including the background of the study, a summary, and a brief critique of each document, can be found in Appendix E.

B.1 Methodology

The Project Team reviewed documents and articles collected from a variety of online sources. In addition, the public recommended 40 documents in comments received during the EIR scoping process and in response to the study notice and other outreach. These 40 documents are listed in Appendix E. Of the 148 documents identified in both the research and public comment, the Project Team was unable to locate 18 documents; these are listed in Appendix E.

B.1.1 Document Relevance

The Project Team initially reviewed the 130 available documents to determine relevance to the trail use safety and conflict subject areas as defined for this Study: information about the frequency and characteristics of incidents and complaints; design of safe shared use trails; the nature of trail use conflict, and management of trail use conflict, all ideally focused on the natural surface trail setting. The review eliminated documents that focused on the issue of dog access or relative environmental impacts of different trail uses. The scope of the Study is defined in more detail in Chapter 1.

The Project Team found 80 of the 130 documents to be relevant; a written summary and critique for these documents is provided in Appendix E. Each summary includes a brief description of the document, including background on the researcher, affiliated organizations, or other available information providing context for the study. All articles in the academic category are peer-reviewed.

Out of the 80 relevant documents, the Project Team identified 16 "key" documents based on the extent to which they address the subject areas of the Study and, in some cases, the frequency with which they were mentioned in the Agency Survey as important references for trail design (most notably the Forest Services' *Trail Construction and Maintenance Notebook*). These 16 most relevant documents are reviewed and critiqued in more detail in this appendix.

Fifty of the 130 available documents were not found to be relevant to user conflict and safety as defined for this Study; these documents are not included in the written review and critique. The reasons for deeming each of these documents not relevant is detailed in Appendix E. Generally, these sources primarily considered the environmental impacts of trail use or discussed paved trails or other subjects not relevant to the current scope. Some of the documents discussed specific examples or arguments for or against allowing various modes on trails. Documents with arguments that were not based on quantitative data, informed opinion, or that did not provide concrete recommendations for addressing trail user conflict or safety issues were not included in the written review.

B.1.2 Criteria for Literature Critique

The review of documents and articles seeks to identify documents that provide accurate, complete, and useful information regarding design of safe shared use trails, the nature of trail use conflict, and management of trail use conflict, with a focus on natural surface trails. The critique of the documents was based on criteria that highlight the relevance and usefulness of each. Criteria include objectivity, thoroughness, applicability, useful information, and sustainability. For each factor, the critique assessed whether the document meets (high), partially meets (medium), or does not meet (low) the criterion.

The critique evaluated the extent to which the documents meet the following criteria:

- Objectivity – Is the document's research methodology rigorous? Is the document based on factual physical or user data, opinion surveys of the subject group, engineering analysis, or peer-reviewed academic research, and does it draw conclusions that specifically follow the data? An objective document is not influenced by personal feelings in representing or considering the facts.
- Thoroughness (breadth and depth of study) – Does the resource thoroughly discuss the context and the specific factors related to multi-use trail safety or conflict and/or provide strategies that consider the full range of factors?
- Applicability – How comparable are the setting, trail facility, and user types to the California State Parks (CSP) trail setting, particularly "soft" or native-surfaced multi-use trails used by hikers, equestrians, and/or mountain bikers?
- Useful Information (detail and specificity) – Within the area of study, does the resource provide specific information regarding the nature of the problem or, in particular, solutions that can be directly used by trail designers and managers to address trail user conflicts and/or safety issues?
- Sustainability – Does the document discuss design for trail safety or reduced conflict in the context of managing or designing for environmental sustainability?

B.1.3 Document Association

Documents are grouped by the author or publisher, and whether either is a government agency or user group, to help identify the impetus for the report. Documents are grouped into the following categories regarding the author's or publisher's association with government or other entities, including user groups:

- Federal – Standards and guidelines published by government agencies such as the Forest Service (USFS), Federal Highway Administration (FHWA), or National Parks Service (NPS).
- General – Design guidelines that serve as a general reference, not published by a government agency or user organization (i.e., written by professionals who do not necessarily manage trails themselves).
- State – California-specific guidance and standard documents, including resources published by California State Parks (CSP) and the California Department of Transportation (Caltrans).
- Local – Design guidelines or studies conducted for a specific jurisdiction.
- Academic – Peer-reviewed articles that were published in a journal or by a university.

- User Organization – Resources published by a formal user group such as equestrian or hiking groups.
- Individual User – Unpublished resources or resources posted online by an individual.

User conflicts on trails tend to be controversial issues that complicate management decisions regarding which users are permitted to use which trails. The authors of literature on the subject may have relationships to or personal preferences for certain types of uses. These relationships in and of themselves have no bearing on the quality of the document; the author's objectivity is identified in the critique. However, it is useful to examine the associations inherent to the documents reviewed.

Some of these user group associations are clear from the source, title, and material in the documents. In other cases the impetus for the document and potential orientation of a particular user group's perspective may not be readily apparent. To the extent practicable, the annotated bibliography notes the authors' association or relationship with organizations. The discussion also notes which groups cite the article, and if it is posted or referenced on a user group website. In the Agency Survey, agency representatives reported using several of the User Organization documents. These references are also noted in the review of each document.

To address interactions and connections between user groups, each entry notes if a particular user group cites the source as a rationale for allowing or prohibiting particular trail uses. The objective for identifying these relationships is not to discredit documents that are produced or favored by a user group, but to acknowledge the relationships.

B.2 Summary of Results

This section presents an overview by topic of the key issues identified and discussed in the Literature Review. It discusses definitions of user conflicts identified through surveys of trail managers and users, as well as theoretical or academic assessment of the nature of recreational conflicts. It also summarizes the solutions and strategies identified for appropriate trail design as well as management and outreach to avoid or minimize conflicts. Each subsection includes citations from documents included in the Literature Review. A summary and critique of the documents are available in Appendix E, Annotated Bibliography.

In the following summary findings, where a theme was cited by a single source, or multiple agency or document sources, the reference follows. Where jurisdictions are cited without a date, the source is that jurisdiction's Agency Survey. If several sources supported the finding, the text provides general reference to support without specifically identifying all documents or agencies.

B.2.1 The Nature of Trail Use Conflict

Despite the wealth of information on the topic of user conflicts on multi-use trails, the majority of the literature does not provide concrete data regarding the presence, extent, or attributes of user conflict. While 63 of the 80 sources included in this analysis define the problem of trail user conflicts, several of them do so as a presupposition based on previous literature (14 sources), or the author's experience (13 sources). Several sources present surveys on managers' perceptions of conflict (9 sources) or users' perceptions of conflict (22 sources). None of these surveys asked the frequency of actual incidents. However, this notable lack of citations regarding specific incidents and accidents indicates that they are infrequent.

Relationship of Conflict to Safety Issues

There is a low incidence of accidents or injuries compared to the extent of perceived conflict and complaints about conflict. Four of the 148 sources reviewed based their analyses on actual incident or complaint data to determine the frequency or rate of conflict. They were consistent in finding a low ratio of actual accidents:

- The National Park Service (NPS) conducted an Environmental Assessment considering the impacts of reopening a section of the Cactus Forest Trail to mountain biker use (2003). During the six month trial period, park staff recorded approximately 1,200 bicyclists, representing nearly half of trail users. Three minor and no major incidents occurred during that period, including a complaint that a bicyclist yelled at a hiker; a complaint that three mountain bikers were riding too fast; and a ranger report that a bicyclist was stopped and advised to yield to equestrians. The safety evaluation found that, "Given the past record of incidents on this trail, however, reinstating mountain bike use would not be considered an unsafe use if recreationists continued to abide by the required trail etiquette rules of the trail."
- In the early 1990's, the North Carolina Department of Parks and Recreation (NC DPR) opened specific trails to mountain bikers on a trial basis (1993). The study estimated that 4,425 mountain bikers used the study trails annually. Three incidents were recorded during the two-year trial period, all of which were accidents involving only a single mountain biker. NC DPR concluded that good design and adequate staff hours to manage complaints are the primary concerns of allowing multiple use trails.
- An early study in the East Bay Regional Park District (EBRPD) found that four of the 24 cycling accidents reported from July 1987 to June 1988 involved a cyclist and another user; two cases involved two bicyclists colliding, one involved a cyclist falling when avoiding a cow, and the final involved a cyclist falling to avoid a hiker (Morioka, Steven in Sloan, D. and T. Fletcher, Ed., 1989).
- A Bicycle Federation of America publication cited two incidents where a horse was spooked by a mountain biker; one in Santa Rosa where the horse broke its leg and had to be shot, and another on Mt. Tam, where a rider was thrown (Keller, 1990).They did not conduct any counts or estimates to determine a rate or frequency of incidents.

In the 1990's, the U.S. Forest Service surveyed trail managers to understand the issues and responses to management of the emerging mountain bike sector. Over half of the 40 surveyed recreational managers from the USFS and Bureau of Land Management reported conflicts between mountain bikers and other user groups. Only one interviewee reported an incident that had resulted in injury and litigation, while the majority of complaints were related to "turf," or users feeling that new users were usurping the trails (Chavez, Winter, and Baas, 1993).

Trail Conflict Perception

Trail use conflict as a social or interpersonal issue is highly influenced by background, orientation, attitude, and other aspects of perception. Numerous surveys of managers and users have identified what parties are in conflict, to what extent they feel bothered by other users, and other facets of conflict. Two themes on user conflict emerged from the results regarding the nature of the problem:

- Trail User Insensitivity - The most common user conflicts concerns expressed include mountain bikers' speeds, lack of warning and/or failure to yield when passing;
- Conflict is a Perception - Concerns about trail conflict are highly subject to perception and orientation – it is a real problem, but it is more a problem of enjoyment and sense of safety than actual risk of incidents on the trail.

Conflict is commonly defined as "goal interference attributed to another's behavior," stating that users' dissatisfaction (conflicts) from a perception that other users are preventing them from actualizing their recreational goals (Jacob and Schreyer, 1980). They note that this goal interference does not necessarily imply goal incompatibility; users may visit the same trail for similar reasons, despite using different modes.

More recently, Moore (1994) advanced this theory of conflict as interpersonal disagreements, writing that "conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users" (Moore, 1994). Watson, a researcher with the Forest Service, observes that perceptions of conflict are frequently unrelated to measurable incidents of interference in outdoor recreation, but rather reflect an attitude towards wilderness and stereotypes of other user groups (2001).

Only 2 percent of users surveyed in Boulder County Parks and Open Space reported experiencing conflict on the day of the survey. One-third reported having experienced a conflict at some point in the past. Nevertheless, users reported several complaints, particularly about mountain bikers' speeds, failure to yield, and not communicating when passing (Bauer, 2004). In Ohio, State Park managers and district supervisors surveyed reported concerns about mountain bikers' excessive speeds and potential for conflict with other users (Longsdorf, 2006).

A 2001 survey of trail users in the Jefferson County Open Space trail system considered the extent to which conflicts between users are interpersonal (based on physical presence of other users) or social (no contact has to occur). The survey supported the studies, finding that all types of users reported more interpersonal (physical interactions between users) than social values conflicts (Carothers, Vaske, and Donnelly, 2001).

Several surveys of trail users have indicated that conflicts between users were highly influenced by perception and orientation. Research conducted in the Bridger-Teton National Forest found that users who had past experience with other trail activities experienced less conflict when encountering participants of those activities than respondents who had never done those activities before. People who had participated in an activity in the past were also more likely to report increased enjoyment due to encounters with that group than were trail users who had never done the activity before, although the relationship was less statistically significant between mountain biking and horse riding (Bradsher, 2003).

A survey conducted for the report, *Perception and Reality of Conflict: Walkers andMountain Bikes on the Queen Charlotte Track in New Zealand* indicated that pedestrians who had not encountered any bicyclists had more negative perceptions of bicyclists than those who actually encountered them (Cessford, 2002). A survey in Wellington Park, Australia found that users had different goals for use of the park; mountain bikers visited the park for 'socializing' and 'excitement/risk', while other users desired 'relaxation' (Chiu and Kriwoken, 2003).

B.2.2 User-Appropriate Trail Design Strategies

There is not a clearly established set of "industry best practices" solutions for appropriate design of multi-use trails documented in the literature. While many sources provided specific trail design parameters, they were primarily general guidelines or standards for trails, rather than design solutions explicitly focused on minimizing incidents between users. Most of the design guideline documents include a brief discussion of designing for shared use, typically without specific design details or specifications to ameliorate these conflicts. Many have general recommendations for adequate widths, sinuosity, or other design elements. The net result is a range of recommendations, and some consensus, regarding the best design measures to address user- appropriate design.

Of the 80 documents included in the Study, 27 contained specific design guidance. This does not include resources that generally stated that good design is important, or that sight lines and width should allow multi-use use, without providing specific dimensions. Figure B-1 shows the frequency of common design solutions cited in all the documents reviewed. For example, the literature that did pertain to design guidelines frequently cited width and passing areas (24 percent), although the dimensions were generally not specific to managing user conflict.

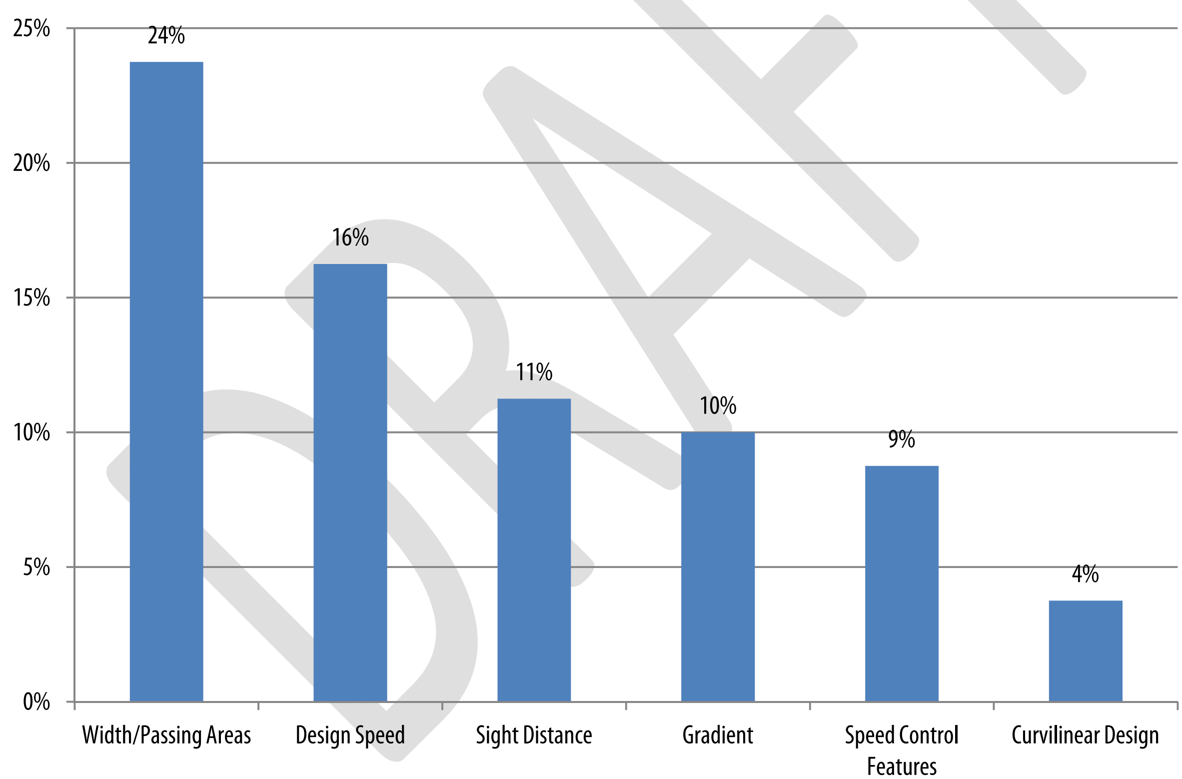

Figure B-1. Common Design Solutions cited in the 80 Literature Sources Reviewed

The following paragraphs highlight the Literature Review results on specific subjects of appropriate trail design for multi-uses.

Trail Width/Passing Areas

Adequate trail bed widths and passing areas were cited as a means to reduce negative conflict perception. Trail width guidance tended to specify widths based on use, type(s), trail context, or trail classification. The width of the trail determines how easily users can pass one another. Elements of width to consider include tread width, bench/clear areas, and passing areas.

Some guidebooks define recommended trail beds or trail clearance widths, which enable trail users to step off the trail and allow another user to pass. Clear area guidance varies from a 2-foot minimum acceptable in low development areas (Forest Service, 2007) to a recommendation of 3 feet clear to either side of the center (Hesselburg, Vachowski, and Davies, 2007).

Passing areas are a sequence of wide points that allow users to let others pass on a narrow trail. The State Parks guidance for accessible trails states that, "where the width of the trail is less than 60 inches, passing spaces measuring 60 inches by 60 inches shall be provided at intervals of 1,000 feet" (99AG-16.2.6; State Parks Accessibility Section, 2005), which is not required on multi-use trails, but is a useful guideline for trails to provide sufficient passing space. Table B-1 shows the variety of guidance related to width and passing. Key width considerations are as follows:

- The Minnesota Department of Natural Resources guide states that, "Trail width must be based on a solid understanding of how a trail will be used since over time it will take the shape users give it" (Minnesota Department of Natural Resources, 2006).The guide recommends 36 inches or more for an easy mountain biker and 72 inches for an 'easiest' mountain biker trail.
- The City of Portland states that hiking/mountain biking/equestrian trails should be 4 feet wide at a minimum with 4-foot passing areas. Ten feet is the maximum width (City of Portland Parks & Recreation, 2009).
- The Santa Monica Mountains National Recreation Area uses an 8-foot minimum bench with a tread of 48 to 60 inches, as well as passing areas twice the width of the trail and approximately 16 feet long (1997).

Table B-1. Summary of Width, Bench/Clear Area, and Passing Area Recommendations

Jurisdiction	Tread Width (feet)	Clear Area/ Bench (feet)	Passing Area
Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds (USFS, 2007)	1.5-2 "low development areas" 6-8 "high development areas"	2	5 feet x 10 feet
Trail Planning for California Communities (Bondurant, Thompson, et. al., 2009)	4-6, 2 minimum	N/A	Provide where width < 5 feet, every 1,000 feet
Trail Use Guidelines and Mitigation Measures. (Midpeninsula Regional Open Space District, 1993)	3-4 minimum	N/A	"Passing often requires moving off the trail"
Trail Planning, Design, and Development Guidelines.(Minnesota Department of Natural Resources, 2006)	3-6	N/A	N/A
Trail Design Guidelines for Portland's Park System. (Portland Parks & Recreation, 2009)	4 minimum; 10 maximum	N/A	4

A few of the guidebooks also address issues with trails being too wide:

- IMBA notes that singletrack trails are more attractive for users and "tend to wind around obstacles" (2007), which is key recommendation for reducing speeds.
- The California Equestrian Trails and Land Coalition (CET&LC) organization notes that wide trails should be avoided to minimize erosion, but trails should be wide enough to provide sufficient space for users to pass each other (CET&LC, 2005).
- Narrower trail width is part of a suite of speed control elements that are important for safe shared trails (Jellum, 2007).

The Forest Service *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* (2007) recommends that when slopes are steeper than 50 percent, consider providing additional horizontal clearance for logs or protruding branches, and widen the trail base along a precipice or other hazardous area (on a 2-foot trail, hazardous segments should be widened to 4 or 5 feet for safety).

Sight Distance

Several sources stated that adequate sight distance should be provided to minimize trail use conflict and maximize safety. Sight distance is the distance that oncoming trail users can see each other. Sight distance recommendations in the literature include:

- The U.S. Forest Service notes that recommended sight distances for equestrians vary and are most commonly 50 to 100 feet (Forest Service, 2007).
- The Midpeninsula Regional Open Space District recommends 100 feet of sight distance on narrow shared trails, with 75 feet acceptable on wider trails (1993).

- Flink, Olka, and Searns recommend a minimum sight distance of 150 feet for bicyclists, 100 feet for equestrians, and 50 feet for pedestrians (1993).
- The City of Portland recommends that sight distance on a hiking/mountain biking trail should be 40 to 100 feet, "depending on speed/flow," and 50 to 100 feet on a hiking/equestrian trail (2009).
- The California Equestrian Trails and Land Coalition (CET&LC) recommends 50 feet of visual clearance on either side on switchbacks and curves so users can see others (CET&LC, 2005).
- Sight distance standards can also vary based on grade; the Santa Monica Mountains National Recreation Area recommends a minimum of sight line of 85 feet for trail with grades of 5 to 10 percent (1997).

Gradient

There was minimal guidance and no standard in the literature regarding the trail gradients that hikers, mountain bikers, and equestrians can comfortably and safely negotiate. California State Parks employs trail grades that will be sustainable for site conditions and the selected use type. With the exception of Accessible trail guidelines, CSP does not have a standard grade requirement for trails. The CSP *Trail Handbook* states: "The parent soil capability, combined with user type, hydrological site conditions, degree of vegetation cover, percent of side slope, the relationship of the hill side cross slope to the trail running grade and season of use shall dictate the percent of trail grade. User comfort shall be a consideration for determination of trail grade, but after all the other conditions outlined above are met. If soils and parent material geologic capability are not sustainable, overly steep grades will be mitigated with surface hardening techniques. Hardening techniques (such as high quality compacted aggregate or trail structures such as steps or retaining walls) shall keep the surface sustainable, firm and stable".

The US Forest Service *Trail Construction and Maintenance Handbook* recommends slopes of 15 percent or less on climbing turns (Hesselbarth, Vachowski and Davies, 2007), while *Trail Planning for California Communities* states that 'wildland trails' should have a 12.5 percent maximum slope (Bondurant, Thompson, et. al., 2009) and IMBA cites a 10 percent average guideline for sustainable trails (IMBA, 2004).

The Forest Service *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* (2007) states that equestrian trails can be as steep as 20 percent grade for no more than 200 feet, while the target grade is less than or equal to 12 percent grade for 90 percent of the trail, otherwise switchbacks should be considered to minimize erosion. On running grades steeper than 5 percent, 6 to 12 inches of extra tread width should be added as a safety margin where possible (Forest Service, 2007).

The City of Portland recommends that hiking/mountain biking/equestrian trails should have grades of zero to 5 percent slope or up to 12 percent as needed (City of Portland Parks & Recreation, 2009). Similarly, CET&LC recommends keeping the slope as low as possible preferably under 12 percent if possible) for safe places for passing and visibility (2005).

On running grades steeper than 5 percent, 6 to 12 inches of extra tread width should be added as a safety margin where possible (Forest Service, 2007). Also, when trails have outslopes of 4 to 5 percent, widening the trail an additional 6 to 12 inches helps stock stay in the center of the tread (Forest Service, 2007).

Elements such as grade reversals and rolling grades also enhance drainage and contribute to a sustainable trail. One type of such element, a 'knick' is a semicircular depression in the trail, about 5 to 10 feet long and is angled about 15 percent for drainage. The Forest Service supports the use of such elements on trails intended for use by equestrians, stating that "Stock tolerate grade reversals, knicks, and rolling grade dips well" (Forest Service, 2007).

Speed Control Features

Several sources state that trail design can control users' speeds by providing features that encourage users to slow down, such as obstacles, choke points, pinch points, stiles, traffic calming, chicanes, traffic calming, and surface irregularity. These features are designed to improve appropriate trail design by requiring that users moderate their speeds, and they can keep users on the trail, thereby reducing erosion. Trail anchors or obstacles can include large rocks, logs, trees or other obstacles that act as a visual and physical barrier showing where the trail is and requiring users to slow down to pass. Choke points, pinch points, or stiles can be rocks or a broken tree trunk that acts as a gateway through which trail users must pass. Uneven trail surface features such as rough native bedrock can also provide this function.

In *Managing Mountain Biking*, IMBA recommends using "trail flow" to control speeds (2007). Strategies for modifying the trail flow include corralling the trail with trail anchors, adding turns, using choke points to visually narrow the trail, and adding surface textures. Other related principles include:

- A stile or pinch point can be the width of the average set of bicycle pedals, plus 2 or 3 inches where wheelchair access is an issue (Goldstein, personal interview with George Geer, a Sunset Unit Ranger with the Arroyo Seco Ranger District in Angeles National Forest, 1987).
- *Trail Solutions: IMBA's Guide to Building Sweet Single-Track* recommends using pinch points to slightly narrow the trail should be install just prior to the area where users should slow down (IMBA, 2004). IMBA recommends providing sufficient sight distance for users to see the obstacle and slow down in advance of the feature.

Surface Texture

In *Managing Mountain Biking*, IMBA recommends adjusting the trail 'flow' with anchors, turns, choke points, and surface textures to control speeds (2007). Sufficient sight distance for users is required to see the obstacle and slow down in advance of the feature, although the document does not recommend specific distances. IMBA notes that a variety of textures created with rocks, roots, and other uneven material is a desirable challenge for mountain bikers and requires that they slow down to maneuver through the area. In addition, IMBA notes that loose soils are more difficult to brake on, and bicyclists may appear out of control when stopping on a loose surface.

Chiu, L. and L. Kriwoken (2003) similarly recommend "leaving obstacles and rough surfaces to slow users down." A technique for creating this texture is to place rocks in the trail tread. Sightlines and a gradual transition are keys to using this technique.

Sinuous Design

Trails naturally follow curves of topography, which can manage users' speeds, contribute to an attractive and interesting trail, and manage drainage to reduce erosion.

An unnamed agency responding to the *Narrow Natural: Managing Multiple Use* study conducted for EBPRD recommended avoiding "fall line trails and switchbacks in favor of designing sinuous trails that include rolling, undulating grades (maximum 10 percent for extended lengths) and curves that provide an interesting user experience" (EBRPD, 2011).

Horses can comfortably negotiate a minimum turn radius of 5 feet, with 6 to 8 feet preferred; when turns are tighter, stock may stumble over their own legs (Forest Service, 2007). The City of Portland recommends a 10 –foot minimum turn radius on a hiking/mountain biking trail/equestrian trail (City of Portland Parks & Recreation, 2009). The minimum suggested radius for a climbing turn is 20 feet. Climbing turns work best when built on slopes of 15 percent or less. In steeper areas, switchbacks are a better choice. (Forest Service, 2007).

B.2.3 Conflict Management Strategies

Most of the documents reviewed cite active management and enforcement and working with user groups and individual users as key to minimizing trail use conflict by adjusting users' perceptions, informing them of appropriate or required behavior, and enforcing the rules of the trail. This section discusses management strategies that were recommended in the literature as a way of reducing user conflicts. The frequency of mention of the various measures by the surveyed agencies is shown in Figure B-2.

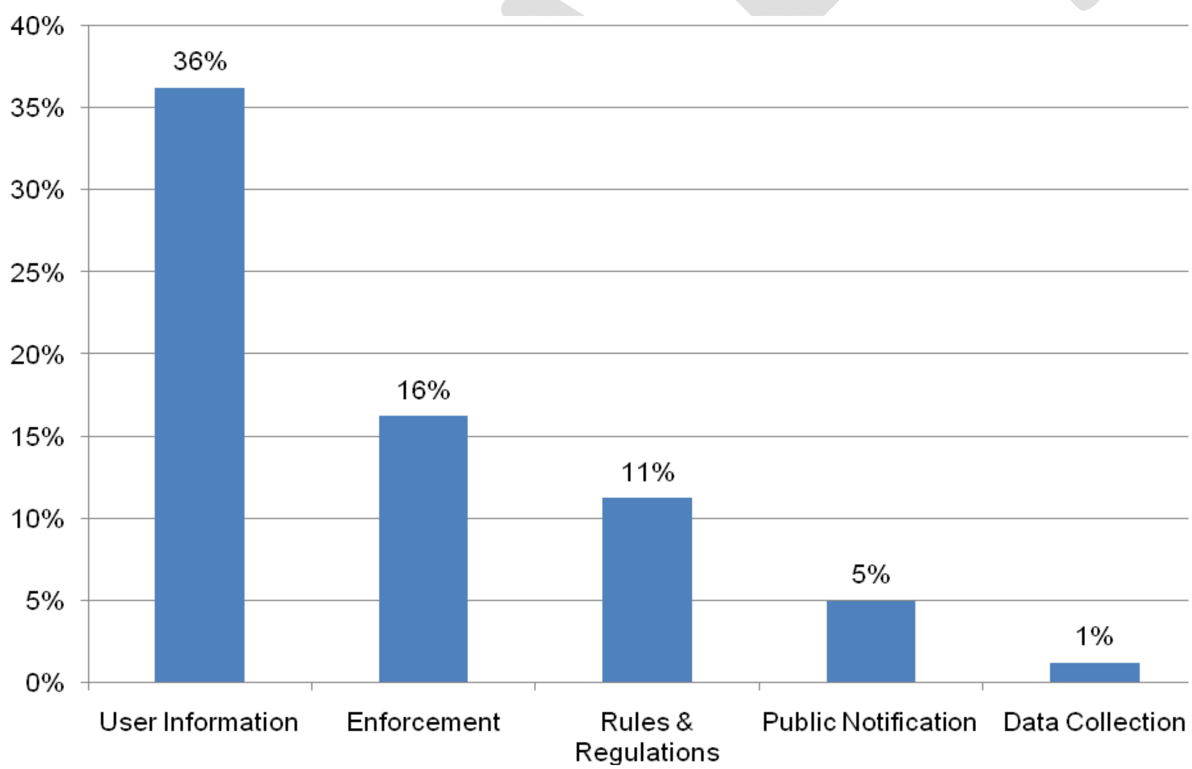

Figure B-2. Common Management Solutions from the 80 Literature Sources Reviewed

A questionnaire given to users of a trail in Wellington Park, Tasmania found that all types of users generally preferred the management strategy of self-regulation. Both mountain bikers and non-mountain bikers desired mountain bike education and information, a code of conduct for mountain bikers, and use of the principle that pedestrians should have right-of-way (Chiu and Kriwoken, 2003).

The North Carolina Department of Parks and Recreation conducted a two-year trial allowing mountain bikers on trails, which found that an average of two staff-hours per week were required to monitor the multi-use trail conditions, while 10 staff-hours were required to respond to complaints resulting from mountain biker use (1993). The study concluded that trails can only be multi-use if adequate staff capacity exists for monitoring.

User Information

Signs tend to be either 'moral appeals' to protect the natural resources and enhance other users' safety or 'fear appeals' that identify consequences for rule breaking (Hendricks, Ramthun and Chavez, 2001). Interpretation messages have been found to be as effective as sanction messages and both types are more effective than no message (Duncanand Martin, 2002).

In situations where hikers do not want to share a trail because of mountain bikers' speeds or fears of being pushes off the trail, agencies have responded by posting signs reinforcing that mountain biking is an allowed use on the trail Chavez (1997).

Signs designating user etiquette may cite specific policies with enforceable regulations, or they may recommend yielding or other good behavior. These regulations, as well as why and how the regulations will be enforced and what the applicable penalties are, should be posted at trailheads and included in trail brochures and on maps (Flink and Searns, 1993). Signs are more effective if they function to activate attitudes and beliefs visitors already hold, instead of trying to instill new beliefs. To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just symptoms (Anderson, Lime, and Wang, 1998).

IMBA's 'Rules of the Trail' are often posted at trailheads to encourage good behavior. Rules include the following:

- Ride open trails.
- Leave no trace.
- Control your bicycle.
- Yield appropriately.
- Never scare animals.
- Plan ahead.

Manning (2003) provides the following 'emerging principles' for information/education programs:

- Maximize efficacy by addressing problem behaviors that are characterized by careless, unskilled, or uninformed actions.
- Connect with or modify visitor attitudes, beliefs, or norms and provide information on the impacts, costs, and consequences of problem behaviors.
- Deliver messages via multiple media, including brochures, personal messages, audiovisual programs, newspapers, magazines, guidebooks, trained volunteers, outfitters, commercial guides, wilderness ranger and volunteer role modeling.

- Design materials for a variety of target audiences and deliver messages in several locations.

Enforcement

Several of the sources generally recommended enhancing enforcement of trail policies. Most of these recommendations are more specifically for ranger patrols or warnings/citations. In *Managing Mountain Bicycling: IMBA's Guide to Providing Great Riding,* IMBA states that patrols act as the 'eyes and ears' of a land manager and can enhance visitor experiences, assist land managers, promote trail stewardship, and respond to incidents (2007). Ranger patrols can cite users who violate posted regulations and record comments or complaints from users. They can also model appropriate behavior.

The *Adoption of Negative Declaration and Policy Related to New Off Road Bicycle Trail in County Parks* in Santa Clara County recommended both staff and volunteer patrols as a key element of managing multi-use trails (1989). In particular, where trails were considered too steep and/or narrow to accommodate multiple uses, the County recommends designating a one-way section and/or having mountain bikers walk, including posting signs and increasing patrols in those locations.

In a study conducted on Mt. Tamalpais, California, both 'moral appeals' to protect the natural resources and enhance other users' safety and 'fear appeals' that identified consequences improved mountain bikers' yielding behavior and had a small impact on reducing speeds over no message. Messages found to come from other mountain bikers were more effective than those coming from a uniformed agency volunteer or a hiker (Hendricks et. al., 2001).

Rules and Regulations

While speed limits are increasingly being used on paved multi-use paths, they are also sometimes used on natural surface trails (Flink and Searns, 1993). However, challenges to the use of speed limits include lack of enforcement staff and users' limited knowledge of the speed they are traveling (Bondurant, Thompson, et. al., 2009).

IMBA discourages the use of speed limits, stating that "speed limits are extremely difficult to enforce, may be unreasonable for trails with constantly changing terrain, probably won't improve real or perceived safety on the trail, and can damage essential respect and trust" (IMBA, 2007).

Flink and Searns recommend enforcing rules and regulations consistently to assure that there is no perception of discrimination among different user groups (1993).They also recommend posting and enforcing regulations from the beginning on new trails to establishing desirable patterns of behavior from the start.

CET&LC feel that law enforcement is a necessary accompaniment to volunteer patrols for enforcing trail rules (2005). Agencies interviewed in the EBRPD *Narrow Natural Surface Trails Study* generally felt that focusing enforcement at parking lots and using radar guns to enforce speed limits were successful strategies (EBPRD, 2011).

One way of engaging trail users who break rules is to consider sentencing trail offenders to work service on the trail as part (or all) of their penalty (Flink and Searns, 1993).

Public Notification

Most agencies alert the public when making planning or policy decisions. However, few of the literature sources cite public notification as a specific strategy used to manage user conflicts. A few sources mentioned working with the public, but did not provide additional details. However, the extensive comments regarding general user group outreach and coordination indicate that formal public notification is occurring as part of the overall process.

Collecting and Tracking Data

A number of the sources noted that managers should begin to track use estimates and complaint/incident data to determine the extent of the problem and to understand root causes. To effectively deter noncompliant behavior, managers must address the reason(s) behind the behavior and not just symptoms (Anderson, Lime, and Wang, 1998). To do this, they recommend gathering incident and complaint data, use estimates, and user surveys.

Use Restrictions

Specific types of use can be allowed on the single tread at different times of day, days of week, and season of the year (Flink and Searns, 1993). Studies are divided on to what extent these management strategies are successful; a survey of mountain bikers in National Forests nationwide found that the management strategy of providing separate trails for different users "was not regarded as a plausible solution by any of the participants"(Hollenhorst, Schuett, and Olson, 1995).

Alternating Days

A study in Chilkoot Trail National Historic Site, British Columbia found that a management strategy that excludes snowmobilers every third weekend successfully reduced goal interference while increasing skiers' satisfaction but reducing snowmobilers' (Jackson, Haider and Elliot, 2004). Both hikers and bikers supported an every-other-day exclusion policy in the Snoqualmie National Forest, Washington (Jellum, 2007).

An Environmental Assessment considered implementing a strategy wherein mountain bikers and equestrians would be allowed on the Cactus Forest Trail in Arizona on alternating days. The analysis of the alternating days scenario noted that, while the potential for conflict would be reduced, "some recreationists may feel constrained, and others may be displaced." The evaluation considered this constraint and displacement to be "adverse, short- to long-term, and of negligible to moderate intensity depending on the individual" (NPS, 2003). This topic was not a focus of the assessment.

One-Way Trails

Single direction trails can alleviate congestion, provide a more predictable experience, and reduce the number of passes between users. Direction restrictions may be combined with user restrictions (such as on a mountain bike only trail), applied to only one type of user, or applied at certain times or days (IMBA, 2004).

The Santa Clara County *Adoption of Negative Declaration and Policy Related to New Off Road Bicycle Trail in County Parks* (1989) recommends that, where trails are too steep and/or narrow to accommodate multiple uses, the they can be designated one-way. This treatment requires posting signs and increasing patrols.

B.2.4 Outreach and Coordination Strategies

User group outreach and coordination can include events that bring trail users together, direct interactions with trail users individually via volunteer programs or in user organizations, as well as education and providing users with information. Agencies are increasingly looking to these types of "bridge building management styles" to engage users and build communities (Chavez, 1996b).Chavez notes that, "the increasing use of this [bridge building] strategy often accompanies decreasing budget allocations."

User group outreach and coordination can include the following strategies:

- Education – user-specific printed materials and web postings, and/or an active, focused public relations campaign.
- Meetings with user groups – including general meetings about specific conflict-related issues or objectives.
- Volunteer programs – ongoing trail patrol and/or maintenance, specific projects, outreach and education – safety and courtesy (e.g. bike bell give-aways): organize, encourage, or support.
- User group notification - of a project or issue with a point of contact and venting opportunity such as comment cards or a web form.
- Events – including multi-user social, fun, trail construction or maintenance events (e.g. Trail Days).Staff could organize, or play a background role to encourage/support user groups who sponsor such events.

Figure B-3 shows the frequency of specific outreach and coordination techniques referenced in the literature.

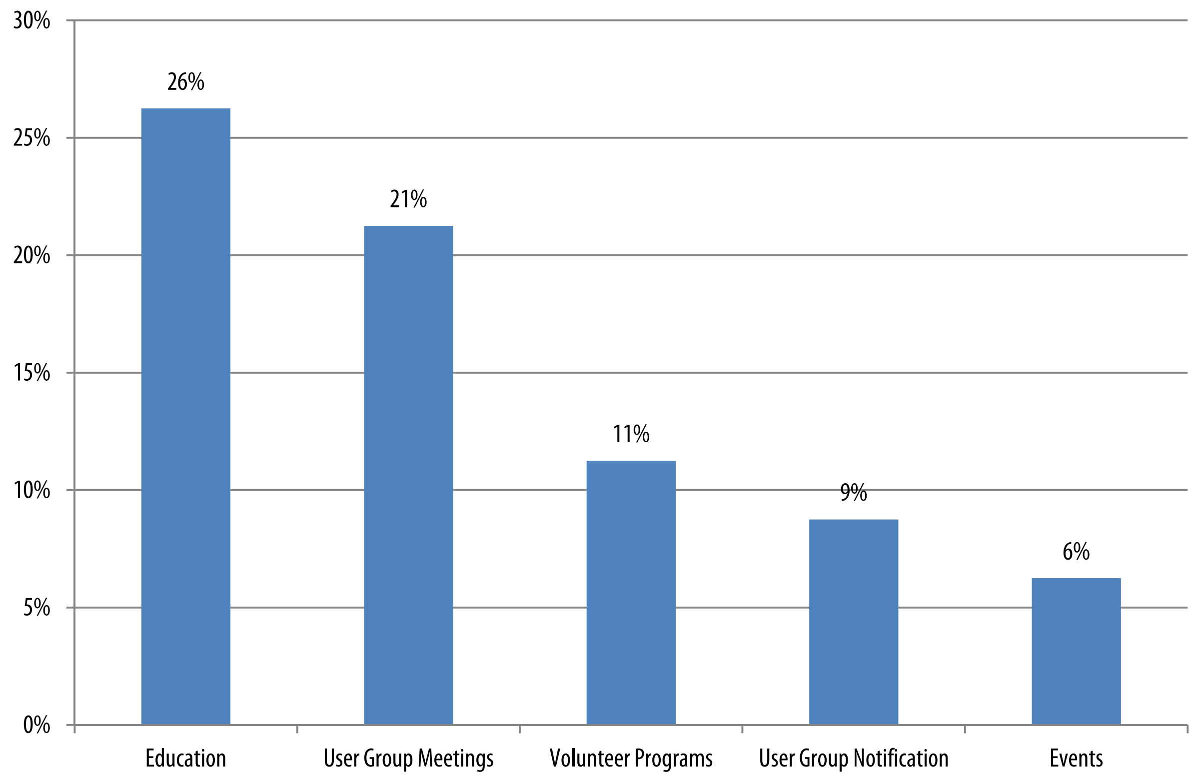

Figure B-3. Common Outreach and Coordination Solutions from the 80 Literature Sources Reviewed

Education

Flink and Searns recommend that "if mountain bikers will be using your trail, you should develop an educational campaign on proper trail use for all users" (1993). Chavez (1997) found that one-on-one education has been used to mitigate a variety of conflict situations, including equestrian complaints about mountain bikes spooking horses, conflict over use of a horse trail by mountain bikers, and hikers not wanting to share trails because of mountain bikers' speeds.

The California Equestrian Trails and Land Coalition recommends that agencies and user groups educate users about the "startle factor" of horses (CET&LC, 2005), both for equestrians to be aware of mountain bikers potentially spooking the horse and for other users about how to act around horses. They recommend holding training clinics for equestrians to teach the horses and riders to meet cyclists in varying situations.

User Group Meetings

IMBA recommends that agencies form formal partnerships with user organizations by writing specific agreements with user groups to define roles and responsibilities. Agreements should start simple and build as the relationship develops. They also recommend creating a plan for ongoing communication with the group (2007).

The East Bay Regional Parks District found that in some cases, collaboration between field staff and the mountain bike and equestrian communities successfully created a shared sense of resource protection and stewardship between staff and bicyclists enthusiasts (EBRPD, 2011).Moore (1994) suggests the following techniques to solicit user involvement in trail planning and management:

- Hold public meetings, issues identification workshops, community design workshops, public hearings, citizen advisory committees, surveys, and mass media outreach.
- Convene a trail advisory council composed of representatives of various user groups.
- Hold joint trail construction or maintenance projects and skills workshops among different user groups.
- Discuss problems with affected user groups via land manager trail walks.

Chavez (1997) recommends forming a multi-user trail group to address hikers' concerns about sharing trails with mountain bikers' due to their speeds.

Volunteer Programs

Volunteers can help with several aspects of trail management; they can reach out to other trail users and educate or appeal to them to yield to other users and they can assist with events such as trail maintenance days and Share the Trail events. Flink and Searns note that trail patrols can hand out maps and brochures, provide information to trail users, and record incident and maintenance needs (1993). They can also carry an aid pack containing a tire patch kit, a spare tube, first-aid supplies, extra fluids, a tire patch kit, and a cell phone (Bondurant, et. al., 2009).

IMBA highly recommends such programs, stating that volunteer patrols are a "tangible reminder that mountain bikers are aware of their potential effect on other visitors, are committed to regulating themselves, and are willing to give back to the trails in the form of volunteerism" (IMBA, 2007).

Another method for involving individual users is through the formation of a Trail Advisory Group. IMBA notes that Trail Advisory Groups can help identify and solve user conflicts before they become serious problems (2007).

Mountain Bikes on Public Land: A Manager's Guide to the State of the Practice (Keller, 1990) provides extensive recommendations for forming volunteer trail patrols. Key considerations are to identify eligibility requirements, such as age, commitment to the goals of responsible cycling, first aid knowledge, and training. An agency staff person can work with the club, whose ultimate responsibility is to train, organize, and manage the volunteers. They can work with rangers in the event of an incident or in situations requiring major first aid or emergency medical services.

Similarly to meetings with user groups, notifying groups when beginning a planning effort encourages users to be involved and invested in decisions. While several sources mentioned working with users in planning efforts, they did not provide substantial information on the topic.

Events

Several sources recommended that agencies organize or facilitate events on narrow natural surface trails that allow different user groups to join in a controlled, cooperative way, such as trail construction, repair, or maintenance work days; competitions such as triathlons and adventure course events that combine kayaking and/or swimming with trail activities, or events that are simply intended to be fun and social.

Moore (1994) suggests the following events to engage a variety of user groups:

- "Trail Days" events sponsored jointly by different user groups.
- Joint fundraising or lobbying efforts.
- "Romp and Stomp" events.

In *Managing Mountain Biking: IMBA's Guide to Providing Great Riding*, IMBA recommends holding 'Romp and Stop' events where mountain bikers and equestrians get together and "ride each others' steeds" (2007).

B.3 Review of Most Relevant Literature

The following pages provide a summary of literature that the Project Team found to be most relevant to the subjects of trail safety and trail user conflicts, using the criteria presented in Section B.1.2 on page B-B-2. The summaries include documents that agencies often referenced as guidelines they use to address user conflicts. These documents provide measurable, specific guidance about the nature of the problem and/or solutions to understanding and dealing with the issues.

Information from each document related to trail user conflicts or design guidelines that may address conflicts is provided, along with the evaluation of the document using the criteria established. Other documents that were included in the analysis but were not considered "key" resources are included in Appendix E. Though these documents were not among the most useful references on trail conflict, they contain valuable information, which is cited in the overall Literature Review results in Section B.2.

The key documents are as follows:

- Chavez, D. J. 1996. *Mountain Biking: Issues and Actions for USDA Forest Service Managers.* Res. Paper PSW-RP-226-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Hesselbarth, W., Vachowski, B., and M Davies. 2007. *Trail Construction and Maintenance Notebook.* FHWA and United States Forest Service.
- Moore, R. L. 1994. *Conflicts on Multiple-Use Trails: Synthesis of the Literature and State of the Practice.* FHWA.
- National Park Service, Department of the Interior. 2003. *Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona.* National Park Service. (Public Review Draft)
- United States Department of Agriculture Forest Service. 2007. *Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds.* 0723–2816–MTDC
- Flink, C., Olka, K., Searns, R., Rails-to-Trails Conservancy. 1993. *Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails.* Island Press.
- MinnesotaDepartment of Natural Resources. 2006. *Trail Planning, Design, and Development Guidelines.* St. Paul, MN: State of Minnesota.
- North Carolina Division of Parks and Recreation. 1993. *Results of the Two Year Mountain Bicycle Trail Study*. North Carolina Division of Parks and Recreation, Department of Environment, Health and Natural Resources.

- Bondurant, J., L.Thompson et. al. 2009. *Trail Planning for California Communities.* Solano Press Books.
- Anderson, D.H. Lime, D. W., and T.L. Wang. 1998. *Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers.* St. Paul: University of Minnesota Extension Service.
- City of Portland Parks & Recreation. 2009.*Trail Design Guidelines for Portland's Park System.*
- East Bay Regional Parks District. 2011. *Narrow Natural Surface Trails: Managing Multiple Users.*
- Hendricks, W., R. H. Ramthun, and D. J. Chavez. 2001. *The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines.* Journal of Park and Recreation Administration 19(3): 38-61.
- Manning, R. 2003. *Emerging Principles for Using Information/Education in Wilderness Management.* International Journal of Wilderness 9: 20-27, 12.
- California Equestrian Trails and Land Coalition. 2005. *Safety Considerations for Multi-Use Trails.*
- International Mountain Bike Association. 2004. *Trail Solutions: IMBA's Guide to Building Sweet Single-Track.* Boulder, CO: International Mountain Bicycling Association.
- International Mountain Bike Association. 2007. *Managing Mountain Biking: IMBA's Guide to Providing Great Riding.* Boulder, CO: International Mountain Bicycling Association.

B.3.1 Mountain Biking: Issues and Actions for USDA Forest Service Managers

Chavez, D. J. 1996. Res. Paper PSW-RP-226-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Background and Context

This article was written by a research social scientist with the Pacific Southwest Research Station's Wildland Recreation and the Urban Culture Research Unit, based in Riverside, California. The study is a continuation of an early 1990s National Park Service study by Tilmant (unpublished) that examined mountain biking on a national scale. The International Mountain Bicycling Association (IMBA) cites this article on their website.

Methodology

The article presents the results of a national survey of U.S. Forest Service (USFS) resource managers from 90 National Forests. The research objectives were to describe the amount of mountain bike riding in National Forests, to determine the level of planning currently used by Forest Service managers to deal with issues related to mountain bike use, and to examine management issues and actions related to mountain bike use in National Forests including resource damage, user conflicts, safety, and accidents.

Findings

The questionnaire results indicate that National Forest managers' primary concerns related to mountain biking include effects on natural resources (42 percent), conflicts with other user groups (34 percent), safety concerns (13 percent), illegal use in designated wilderness (13 percent), and the growth of the sport (12 percent). In addition, 70 percent of managers had received reports of user conflicts and 48 percent noted specific problems related to incidents. The most significant conflict issues reported were those between mountain bikers and equestrians (41 percent) and mountain bikers and hikers (31 percent). Twenty-one percent reported that the problems were due to the speed of mountain bikers, while 11 percent felt it was generally the other party's behavior.

Managers responded to an open-ended question about the methods they use to reduce user conflicts. The responses were grouped into the following categories:

- Information/education (63 percent) – Safety, brochures, posters, signs, IMBA triangle, etc.
- Cooperation (27 percent) – Personal interactions, volunteer patrols, partnerships, and providing mountain bike shops with rules and regulations.
- Visitor restrictions (17 percent) – Separate user groups, separate trails, alternating use between user groups, redirecting bike use to other trails, law enforcement, and denial of event permits.
- Resource hardening (7 percent) – Changing trail to meet needs, shorter loops for hikers, longer for mountain bikes, and upgrading trails.

The survey asked about safety problems (incidents) and accidents separately from user conflicts. Most managers had observed or reported safety problems (incidents) related to mountain bike use (59 percent), while almost half had observed or received reports of accidents involving mountain bikes (48 percent). Issues included excessive mountain biker speeds, concerns about pack animal groups, mountain bikes that were too quiet (they did not warn other users they were approaching), and mountain bikers being careless around vehicles. Responses to safety issues were categorized in the following ways:

- Information/Education (58 percent) – Safety rules, multiple uses, brochures, maps, trail descriptions, newspaper articles, club newsletters, signs with appropriate use, ethics, etiquette, and low impact use.
- Cooperation (17 percent) – Personal contacts, partnerships, and workshops.
- Visitor Restrictions (12 percent) – Separate trails, enforcement contacts, and non-issuance of special use permits.
- Resource hardening (8 percent) – Wider turnouts and rubber belting on water bars.

Managers also recommended additional research studies on the following: the value of bike patrols and partnerships for alleviating conflict or resource damage; trail construction that can alleviate trail damage; mountain biking interactions with the community; and an evaluation of whether displacement of trail users is an issue.

Chavez concludes that, "trail maintenance is a reasonable way to deal with safety and accident problems, and information and personal interaction are the most reasonable tools for dealing with conflict issues."

Critique

Objectivity:	High	Chavez's conclusions are direct observations based on an extensive survey of Forest Service trail managers' professional opinions. Her recommendations are limited to identification of additional research needs; they do not exceed the data.
Thoroughness:	High	The article presents a definition of conflict and safety issues, as well as a large range of solutions, including specific information/education, cooperation, visitor restrictions, and resource hardening strategies.
Applicability:	High	The analysis specifically focuses on trail use conflicts and safety issues on soft-surface trails shared with hikers, equestrians, and mountain bikers.
Useful Information:	Medium	While the survey identifies conflict and safety issues as well as strategies to address these issues, the results do not include measureable design guidance or an analysis of the effectiveness of measures.
Sustainability:	Medium	The survey asked about resource damage, but Chavez does not analyze the interactions between the stated survey responses related to safety, user conflict, and resource damage issues.
Keywords:	Problem definition (manager survey), trail layout/availability, user group notification, volunteer programs, events, user group meetings, public notification, user information, alternate use days, enforcement	

Mountain Biking: Issues and Actions for USDA Forest Service Managers **Lessons Learned**

Design Best Practices

- Provide shorter loops for hikers and longer loops for mountain bikers.

Management Best Practices

- Inform users of etiquette and expectations through brochures, posters, signs, and the yielding triangle.
- Use partnerships, personal interactions, and volunteers to engage visitors.

B.3.2 Trail Construction and Maintenance Notebook

Hesselbarth, W., Vachowski, B., and M Davies. 2007. FHWA and United States Forest Service.
http://www.fhwa.dot.gov/environment/fspubs/07232806/index.htm

Background and Context

This online resource is a handbook of Best Management Practices (BMPs) for physical trail construction and maintenance, particularly gravel and dirt trails. It was produced by the Forest Service in cooperation with the Recreational Trails Program (RTP), and several agencies report using it as a design resource in the Agency Survey.

Methodology

The Trail Construction and Maintenance Notebook (Notebook) is based on the professional expertise and experience of the authors. A long list of contributors and reviewers indicates thorough oversight. The

Notebook includes the following: guidance for drainage, erosion, grade, and alignment; tools and methods of trail construction; standards for decommissioning trails; and signs and wayfinding guidance.

Findings

The majority of the recommendations address drainage and other environmental concerns of trails, rather than addressing safety issues or conflicts between users. The Notebook recommends leaving tree stumps in order to minimize downhill trail creep, but it does not mention the possible speed control benefits.

Critique

Objectivity:	High	A FHWA and RTP publication, the recommendations in this document are based on extensive experience and expert review, as well as engineering judgment.
Thoroughness:	Medium	The Notebook discusses specific standards of trail design, but it does not address either trail use conflict in general or specific management or outreach strategies.
Applicability:	Medium	The Notebook discusses soft-surface trail design, but it does not explicitly consider designs for multi-use trails.
Useful Information:	Medium	The standard specifications for sustainable trail design are useful to this Study, but the Notebook does not discuss techniques to design for multi-use.
Sustainability:	Medium	The Handbook provides standard specifications for sustainable trails, but they are not discussed in relation to design for multi-use.
Keywords:	Design guidelines, width/passing area, user information	

Trail Construction and Maintenance Notebook Lessons Learned

Design Best Practices

- Clear a hiking trail corridor for a distance of three feet either side of center.
- Use grade reversals at natural dips in the terrain (10 to 15 feet for the reversed grade) to keep water moving across the trail and minimize maintenance; place every 20 to 50 feet.
- When constructing a trail, leave roots that are perpendicular to the tread, fairly flush, and not a tripping hazard.
- Consider leaving large rocks along the trail to keep the trail from creeping downhill.

B.3.3 Conflicts on Multiple-Use Trails: Synthesis of the Literature and State of the Practice

Moore, R. L. 1994. www.americantrails.org/resources/ManageMaintain/MooreConflictMgmt.html

Background and Context

Conflicts on Multiple-Use Trails (1994) is a well-referenced guide to trail user conflicts. The article is a synthesis of existing literature created by the National Trails Training Partnership for the Federal Highway

Administration (FHWA). IMBA cites this article on their website. The article provides guidance for reducing user conflict through information, education, regulations, and enforcement.

Methodology

Moore cites many other peer-reviewed articles, upon which he bases his conclusions. He notes that many trail managers and professional experts were involved in the research for and writing of the report.

Findings

Moore briefly discusses maintaining user safety, citing the following threats to user safety: collisions, reckless and irresponsible behavior, poor user preparation or judgment, unsafe conditions related to trail use (e.g., deep ruts, tracks on snow trail, etc.), unsafe conditions not related to trail use (e.g., obstacles, terrain, weather, river crossings, etc.), poor trail design, construction, maintenance or management, and other hazards (e.g., bears, lightning, cliffs, crime, etc.). His recommendations for maintaining safety on the trail include manager control or influence over the following factors:

- User speed (often has more to do with speed differential than speed itself)
- Mass of user and vehicle (if any)
- Sight distances
- Trail width
- Trail surface
- Congestion (e.g., number of users per mile)
- Users overtaking one another silently/without warning
- Trail difficulty (obstacles, terrain, condition, etc.)
- User skill level and experience
- User expectations and preparedness (e.g., walkers who understand they may see bicycles on a particular trail can better prepare themselves for possible encounters)
- Emergency procedures
- On-site management presence

Moore focuses his analysis on conflicts between users, noting that no actual contact between users is necessary for conflicts to occur. He states that, “conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users.” Conflicts arise and are exacerbated by many factors, including an increased demand for trail resources, increased use of existing trails, poor management, under-designed facilities, lack of user etiquette, and disregard for the varying abilities of trail users.

Moore identifies the following 12 principles for minimizing user conflicts on multi-use trails. The principles relevant to this study are listed below:

- Recognize conflict as goal interference.
- Provide adequate trail opportunities.
- Minimize number of contacts in problem areas.
- Involve users as early as possible.
- Understand user needs.
- Identify the actual sources of conflict.
- Work with affected users.
- Promote trail etiquette.

- Encourage positive interaction among different users.
- Favor "light-handed" management.
- Plan and act locally.
- Monitor progress.

Moore lists specific techniques that have been used for reducing user conflicts, separating responses into two categories: physical responses (i.e., design trails in a way that encourages users to behave in more appropriate ways) and management responses. Management responses are divided into “information and education” and “regulations and enforcement.”

Critique

Objectivity:	High	Moore based his conclusions on peer-reviewed research. The article was published by the National Trails Training Partnership for FHWA, and many professionals and experts reviewed and contributed to the article.
Thoroughness	High	Moore provides a detailed analysis of previous scholarship on trail conflicts and details a variety of specific management and outreach techniques.
Applicability	High	This article explicitly discusses conflicts between users on multi-use paths.
Useful Information	High	Moore provides specific recommendations for each recommended strategy to address trail user conflict, including physical and management responses.
Sustainability:	Medium	Moore briefly discusses protecting natural resources, as well as how perceptions of some users’ impacts can contribute to perceptions of conflict, although it is not the main topic of the article.
Keywords:	Problem definition (theoretical), design guidelines, trail layout/availability, education, user group notification, volunteer programs, events, user group meetings, user information	

Conflicts on Multiple-Use Trails Lessons Learned

Outreach Best Practices

- Hold public meetings, issues identification workshops, community design workshops, public hearings, citizen advisory committees, surveys, and mass media outreach.
- Convene a trail advisory council composed of representatives of various user groups.
- Organize joint trail construction or maintenance projects and skills workshops among different user groups.
- Discuss problems with affected user groups via land manager trail walks.
- Organize events such as "Trail Days" co-sponsored by different user groups, joint fundraising or lobbying efforts, and "ROMP and STOMP" events involving mountain bikers and equestrians.

B.3.4 Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona

National Park Service, Department of the Interior. 2003. National Park Service. (Public Review Draft)

Background and Context

This Environmental Assessment published by the National Park Service considers the impacts of reopening a section of the Cactus Forest Trail to mountain biker use. The trail had allowed mountain bikers but was closed due to "claims by an organization of environmental professionals that the trail was initially opened without proper authorization." The three alternatives considered included (1) keeping the trail closed to mountain bikers, (2) reopening the trail to mountain bikers, and (3) opening the trail to equestrians and mountain bikers on alternate days.

Methodology

During the six month trial period, the park collected information on the amount of use, total number of complaints and compliments, major and minor incidents, and unauthorized mountain bike use in other areas of the park. The Service's stated visitor safety goal was to "identify recognizable threats to the safety and health of persons and to the protection of property." They recorded approximately 1,200 mountain bikers, representing nearly half of trail users. Three minor and no major conflicts occurred during that period: a complaint that a bicyclist yelled at a hiker; a complaint that three mountain bikers were riding too fast; and a ranger report that a bicyclist was stopped and advised to yield to equestrians.

Findings

The analysis found that "Visitor Use, Understanding, and Appreciation" may be increased for bikers and equestrians if mountain bikers were prohibited from the trail, but "given the number of other trails within the park that are closed to mountain bikes the impact to hikers and equestrians would be localized and of negligible to minor intensity." Impacts to local mountain bikers were seen as "adverse and long-term." Reopening the trail to mountain biker use would be beneficial for mountain bikers, and impacts to hikers and equestrians were seen as, "adverse, long-term, and minor." For visitor safety, the Environmental Assessment concludes that the impact of reopening the trail to mountain bikers would be negligible to minor, stating that, "given the past record of incidents on this trail, however, reinstating mountain bike use would not be considered an unsafe use if recreationists continued to abide by the required trail etiquette rules of the trail."

The discussion of the alternating days scenario noted that, while the potential for conflict would be reduced, "some recreationists may feel constrained, and others may be displaced," which was considered "adverse, short- to long-term, and of negligible to moderate intensity depending on the individual," with respect to impact. The safety evaluation found that, "the potential for accidents could vary depending on such factors as the ability of the rider and the number of other cyclists and hikers on the trail. Past incident reports, however, do not indicate that safety was an issue between bicyclists and other trail users."

The document concludes that the preferred alternative is to reopen the trail to mountain bike use, as not doing so would impact visitor safety and have "adverse, long-term, negligible to minor impacts."

Critique

Objectivity:	High	This Environmental Assessment was written by the National Park Service and conclusions are based on data collected by the Park staff during a six-month trial period. The document also underwent a thorough public review process.
Thoroughness	High	The document presents a detailed analysis of soils, vegetation, wildlife, archeological resources/historic structures, visitor use, visitor safety, and park operations. It primarily considers management strategies.
Applicability	High	This document is an example of a jurisdiction conducting a process to determine use on a soft-surface trail and is therefore quite relevant to California State Parks' change-in-use process.
Useful Information	High	This Environmental Assessment is one of the three documents reviewed that relied on actual data to determine safety. It provides a detailed critique of management strategies to address safety, user conflict, and environmental consequences.
Sustainability:	Medium	The Environmental Assessment considers the environmental consequences of opening the trail to mountain bikers, but does not present design criteria for both sustainability and multi-use.
Keywords:	Problem definition (count/incident data), alternate use days	

Cactus Forest Trail Environmental Assessment Lessons Learned

Management Best Practices

- Opening the trail to mountain bike use, in this case, was not considered a safety issue.
- Consider trail availability for users within the system when determining use on a specific trail.

B.3.5 Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds

United States Department of Agriculture Forest Service. 2007. 0723–2816–MTDC
http://www.fhwa.dot.gov/environment/fspubs/07232816/pdf07232816dpi72all.pdf

Background and Context

This guidebook was published by the U.S. Forest Service, in cooperation with FHWA and funded by RTP. The document provides practical guidance for designing trails and other facilities for use by equestrians. It summarizes considerations for planning with horses in mind, including a 4-foot estimated width of the horse with a rider.

Methodology

The planning trail systems chapter provides a list of questions for determining whether a trail is suitable for equestrian use. Questions pertinent to this Study include:

- Is the trail corridor wide enough to accommodate many trail users, including stock and their riders? Is the anticipated trail appropriate for equestrian use?

- Is the trail corridor free of hazards or potential safety problems that would affect riders? Do trail conditions, such as separate treads for different non-motorized users, promote a sense of safety?

While these questions show how trail design can influence user safety, the second bullet implies that physical design can influence perceptions of safety. The report refers to Moore (1994) for additional information on interactions between trail users.

Findings

The document quotes IMBA's trail etiquette, which includes, "Give animals extra room and time to adjust to you. When passing horses, always use special care and follow directions from the horseback riders (ask if uncertain). Running cattle and disturbing wildlife is a serious offense. Leave gates as you found them, or as marked."

Specific guidelines for designing trails to accommodate equestrians include the consideration that stock tend to travel about 18 inches from the edge of the tread surface, and have an approximately 2-foot shy distance from obstacles. The guide recommends a 5- to 6-foot tread with 'adequate clearance.'

A call-out box discussing 'Mixing Bicycle and Horse Use' states that equestrians' and bicyclists' ability to share a trail may reflect the local cycling style and local circumstances or customs. The guide explains the prevalence of separating users as being because the sudden appearance of bicyclists can unnerve stock, as well as equestrians' desire to ride on an natural surface surface. It provides guidelines for multiple tracked trails, including treads separated by distance. Additional guidelines pertain to recommended sight distance, tread and clearing widths, turn radii and switchbacks, and design of crossing features.

Critique

Objectivity:	High	The Guidebook was published by USFS and FHWA, and many professionals and experts contributed to the recommendations.
Thoroughness:	High	The Guidebook addresses many trail design issues, as well as recommending strategies to minimize conflicts and potential incidents with mountain bikers.
Applicability:	Medium	The majority of the recommendations in the Guidebook are intended for trails where riding is the primary purpose, or for a shared hiker/equestrian trail, rather than trails that accommodate mountain bikers as well.
Useful Information:	Medium	Specific design recommendations for trails that also accommodate mountain bikers as well as equestrians and hikers are minimal.
Sustainability:	Medium	The Guidebook discusses sustainable trail design such as grade reversals and gradient, but does not provide design guidance for sustainability and multi-use.
Keywords:	Problem definition (general), design guidance, width/passing area, gradient design speed, sight lines, trail layout/availability	

***Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds* Lessons Learned**

Design Best Practices

- Provide a space 5 by 10 feet to allow a single trail animal to pull off the tread.
- Equestrian trails can be as steep as 20 percent grade for less than 90 percent of the trail, otherwise switchbacks should be considered to minimize erosion. On running grades steeper than 5 percent, add 6 to 12 inches of extra tread width as a safety margin where possible.
- When slopes are steeper than 50 percent, consider providing additional horizontal clearance for logs or protruding branches widen the trail base along a precipice or other hazardous area (on a 2-foot trail, hazardous segments should be widened to 4 or 5 feet for safety).
- Recommended sight distances for equestrians vary, and are most commonly 50 to 100 feet.
- Use a minimum radius of 5 feet (6 to 8 feet preferred) on trail curves and turns; stock may stumble where turns are tighter. For a climbing turn, use a minimum radius of 20 feet, with a slope of 15 percent or less. Consider switchbacks in steeper areas.

B.3.6 Trails for the Twenty-First Century

Flink, C., Olka, K., Searns, R., and Rails-to-Trails Conservancy. 1993. Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails. Island Press.

Background and Context

Trails for the Twenty-First Century was authored by Flink, Olka, and Searns, who are trail planning and designing professionals, along with the Rails-to-Trails Conservancy and the National Center for Recreation and Conservation Division of the National Park Service. The second edition was sponsored by the Federal Highway Administration (FHWA).

Methodology

The book "was written to help those who are planning, designing, building, and managing multi-use trails" and presents a thorough discussion of considerations for both paved and soft-surface trails, as well as designing trails to accommodate multi-use.

Findings

Flink, Olka, and Searns advocate for designing trails with specific users in mind to avoid conflict and unsafe trail conditions. *Trails for the Twenty-First Century* states that speed issues are better addressed through design, as speed limits require consistent, ongoing enforcement and may not improve real or perceived safety on the trail. Where speed limits are created, strategies to increase compliance can include informing users of the regulations, communicating the reasons for regulations to the users affected, and considering sentencing trail offenders to work service on the trail as part (or all) of their penalty.

They propose six alternative layouts for land-based trails, varying single or multiple treads, and responding to the number of user types. Users can also be separated via time of use, zoning, and skill levels or preferences.

The book presents a case study on 'Resolving Conflicts between Cyclists and Equestrians' that highlights ROMP n' STOMP events where equestrians and mountain bikers use trails together to build partnerships and mutual understanding. The recommended response to conflict issues is therefore to improve perceptions of other users.

Critique

Objectivity:	High	This manual was written in association with the Rails to Trails Conservancy, and is disseminated under the sponsorship of FHWA. The authors are trail design professionals and the book cites many other professionals and experts on the subject.
Thoroughness:	High	This manual provides detailed design guidelines for developing a variety of types of trails, as well as general information about defining conflict and conflict strategies.
Applicability:	Medium	The manual provides guidance on the design of all types of trails, including ones not pertinent to this Study. The manual briefly discusses soft-surface multi-use trails, but they are not the main focus of the manual.
Useful Information:	Medium	The primary useful information for this Study is management and outreach strategies for engaging users, although they are not explicitly related to user conflict.
Sustainability:	Medium	The manual discusses sustainable trail design, but does not integrate with design for multi-use.
Keywords:	Problem definition (general), design guidance, width/passing areas, design speed, sight lines, trail layout/availability, education, rules and regulations, enforcement	

***Trails for the Twenty-First Century* Lessons Learned**

Design Best Practices

- Avoid use of speed limits, but use a 15 mph design speed for natural surface paths.

Management Best Practices

- Post and enforce regulations from the very beginning on newly opened trails. Establishing desirable patterns of behavior from the start is far easier than trying to change bad user habits later on.
- Enforce rules and regulations consistently to assure that there is no perception of discrimination among different user groups.
- Employ a variety of on-site enforcement personnel if possible and appropriate, including: peer policing programs (e.g., peer pressure); volunteer trail patrols, and uniformed enforcement officers.
- Consider sentencing trail offenders to work service on the trail as part (or all) of their penalty.

Outreach Best Practices

- Develop an educational campaign on proper trail use for all users if mountain bikers will be using the trail.
- Have trail patrols hand out maps and provide information to trail users, and record incident and maintenance needs.
- Post regulations at trailheads and include them in trail brochures and maps.

- Communicate why and how the regulations will be enforced and what the applicable penalties are.
- Form cooperative agreements with local law enforcement and fire protection agencies.

B.3.7 Results of the Two Year Mountain Bicycle Trail Study

North Carolina Division of Parks and Recreation. 1993. North Carolina Division of Parks and Recreation, Department of Environment, Health and Natural Resources.

Background and Context

This study was conducted by the North Carolina Division of Parks and Recreation (NC CSP) in response to the department's recognition that its "lack of mountain bicycle trail management experience would make it difficult to reach or defend any decision to permit or deny mountain bicycling use within units of the state park system." It was developed by a Quality Action Team comprised of:

- Walt Gravley, Superintendent, South Mountains State Park.
- Ob Davies, Chief Ranger, William B. Umstead State Park.
- Marshall Ellis, Natural Resource Management Section.
- Darrell McBane, State Trail s Coordinator.
- Tom Potter, Regional Trails Specialist.
- Dwayne Stutzman, Regional Trails Specialist.

IMBA cites this article on their website.

Methodology

NC CSP initially surveyed other state parks systems to gather information on how to manage mountain bikers. However, the information was inconclusive, and a two-year study was commissioned. Mountain bikers were allowed on designated multi-use trails in William B. Umstead State Park and South Mountains State Park, and significant data was collected to support the conclusions.

One of the surfaces tested in the experiment was an 8-foot wide roadbed with a compacted soil surface; other trails were paved or wider. Criteria selected to study the effects of mountain bikers included natural resource protection, visitor safety, operational impacts, and user satisfaction. Visitor safety was measured by case incident reports filed and user comments.

Findings

Three incidents occurred during the study period; all were accidents that did not involve other users. Staff did receive several verbal comments, predominantly from equestrians who questioned mountain bikers' presence on the trails, in particular on the first half-mile of trails from the parking lot. Complaints included mountain bikers weaving in and out of traffic and passing too closely to hikers at high speeds and without warning.

NC CSP also found that an average of two staff-hours per week were required to monitor the multi-use trail conditions, while 10 staff-hours were required to respond to complaints resulting from mountain biker use. In addition, mountain bikers noted that the wide road was a less-desirable trail than a narrower 18- to 24-inch singletrack. The report recommends having mountain bikers walk near the trailhead, where more users are present.

Critique

Objectivity:	High	This report is the results of a two-year study of the impacts of allowing mountain bikers, and the conclusions are closely related to the study findings. The report makes recommendations
Thoroughness:	High	The report analyzes a wide range of impacts, including natural resource protection, visitor safety, operational impacts, and user satisfaction.
Applicability:	Medium	The trails studied in this report are 8 feet or wider, and therefore do not replicate the trails under consideration by CSP. Nevertheless, this report represents one of the few data-driven analyses on multi-use soft-surface trails available.
Useful Information:	Medium	While the report makes clear conclusions and recommendations for the specific condition being studied, the information has moderate specificity a limited applicability outside of the NC CSP situation.
Sustainability:	High	The report considers resource preservation and integrates the design and management recommendations with the recommendations for multi-use.
Keywords:	Problem definition (count data), design guidelines, width/passing areas, user information	

***Results of the Two Year Mountain Bicycle Trail Study* Lessons Learned**

- No incidents involving user conflict were recorded during the two-year study period.

Design Best Practices

- Minimum use criteria for allowing mountain bike use:
    - Average width of 8 feet.
    - Minimum standard for trail surface is compacted soil.
    - Minimum length of 10 miles.
    - Average slope of 10 percent with 25 percent maximum.

Outreach Best Practices

- Only allow multiple use where sufficient staff capacity exists to monitor trail conditions and maintain the trail.

B.3.8 Trail Planning for California Communities

Bondurant, J., L.Thompson et. al.. 2009. Solano Press Books

Background and Context

This 400-page book is a comprehensive guide for recreational trail planning. The primary authors are (Bondurant) a Senior Park Planner with EBRPD and (Thompson) the manager of the San Francisco Bay Trail Project. Many other “contributing partners” also assisted with the development of the guide.

Methodology

The guide presents detailed recommendations about policy and regulation, community involvement in trail building, legal responsibilities, trail design, permitting, funding, and maintenance. It describes and proposes designs that separate users or serve particular groups of users, and references existing, successful trail designs and planning measures.

Trails particularly relevant to this Study are fire roads and wildland trails, although the guide does not provide specific instructions for selecting width or mitigating user conflicts on a single-track.

Findings

Bondurant presents a wide range of design, planning, and management considerations and specifications. Those that are pertinent to this Study are included in the findings and recommendations in the Study.

Critique

Objectivity:	High	The book is authored by two main authors, nine contributing authors, and 25 direct contributors, who range from trail management agency staff to planning and design professionals. The recommendations are based on this significant expert and professional experience.
Thoroughness:	High	Bondurant et. al. discuss a great breadth and depth of information related to trail design and management. They also discuss multi-use issues and considerations.
Applicability:	High	The book discusses planning, design, and management considerations by trail classification. Where considerations pertain to wildland trails, the information is specifically related to the topic of this Study.
Useful Information:	Medium	This book contributes a information to the appropriate design of multi-use trails, as included in Section B.2., although it does not specifically discuss measurable designs for multi-use wildland trails.
Sustainability:	Medium	The authors discuss design for trail sustainability, albeit separately from managing multiple uses in a sustainable way.
Keywords:	Problem definition (general), design guidelines, width/passing areas, gradient, design speed, sight lines, trail layout/availability, user information	

***Trail Planning for California Communities* Lessons Learned**

Design Best Practices

- Build trail 4 to 6 feet wide, widths as narrow as 2 feet are acceptable in natural surface conditions.
- Provide clear passage along the full width of the trail and an average sight line of 100 feet.
- Grade for wildland trails: 12.5 percent maximum.

Management Best Practices

- Post trail regulations and rules on signs in prominent locations.
- Develop enforcement policies.
- Maintain a uniformed presence on the trail.
- Provide adequate trail mileage and disperse users among several access points, oriented to different user groups.

Outreach Best Practices

- Provide brochures and newsletters with basic safety information.
- Distribute maps that clearly delineate where various uses are acceptable.
- Institute safety program days and presentations given by trail staff to schools, recreation, civic groups, etc.
- Develop a consensus-building process.

B.3.9 Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers

Anderson, D.H. ,Lime,D. W., and T.L. Wang. 1998. St. Paul: University of Minnesota Extension Service. http://cpsp.cfans.umn.edu/publications/revtactics_handbook.pdf

Background and Context

This handbook provides resource managers with a step-by-step, easy-to-use process for identifying and defining unacceptable impacts to biological and cultural resources and to visitor experiences, and identifies strategies and tactics to address unacceptable impacts to resources and experiences. The handbook was commissioned by the National Park Service (Denver Service Center) as a complement to the Visitor

Experience and Resource Protection (VERP) framework.

The handbook was field-tested in 1997 in four National Park Service units (Arches, Mesa Verde, Grand Teton, and Yellowstone national parks) and is built on the publications by Cole, Petersen, and Lucas (1987), *Managing wilderness recreation use: Common problems and potential solutions*; and Cole (1989b), *Low-impact recreational practices for wilderness and backcountry*.

Methodology

The handbook defines a decision process of five stages: (1) problem awareness, (2) problem specification, (3) strategy and tactic selection, (4) plan implementation, and (5) monitoring. Problems are defined as unacceptable visitor-caused impacts to biophysical resources and visitor experiences.

Findings

Problems related to visitor experiences include:

- Visitor conflicts due to incompatible uses, encounters with large groups or parties dissimilar to one's own, or rowdiness by itself or in combination with excessive consumption of alcohol and visitor displacement (spatial, temporal, or total).
- Inadequate or inappropriate levels of access to facilities, natural areas, or cultural resources; facility design that fails to accommodate the needs of the broadest possible spectrum of people, including persons with disabilities.
- Threats to visitor safety, behavior that jeopardizes the safety of the individual or of other visitors, failure to maintain a safe environment through facility design, maintenance, or other means.

The handbook provides three worksheets associated with the decision process, which are used for problem specification, to define what the acceptable resource condition would be and what the existing impact is, and finally the possible causes of any impacts that are determined to be unacceptable or approaching unacceptable levels. If indicators or standards are not prescribed for a given impact, the manager determined what is acceptable or how much impact can be tolerated before management intervention is required.

Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers recommends the following selection criteria for management tactics:

- Does the tactic adequately address the root cause of the visitor use problem?
- Is the tactic direct or indirect in terms of how it operates on visitor behavior?
- Is the tactic subtle or obtrusive in terms of visitor awareness of being managed?
- Does the tactic preserve visitor freedom of choice?
- Does the tactic affect visitors offsite during the planning stages of their trip? Or does the tactic affect visitors onsite while they are engaged in their recreational experience?
- Does the tactic affect a large or small number of visitors? Are those affected primarily visitors who are generally not responsible for the impact(s) in question?
- Does the tactic affect an activity to which some visitors attach a great deal of importance?
- Are visitors likely to resist the management action?
- What are the costs to managers in terms of tactic implementation and administration, including facility construction, operation, and maintenance, staff workload, and communication and enforcement costs? Are any of these limiting factors?
- How effective is the tactic likely to be at solving the visitor use problem in question?
- Is the tactic likely to lead to the creation of a new problem?

(Anderson, Lime, and Wang, 1998)

The handbook outlines five general management strategies to address unacceptable impacts:

- "Modify the character of visitor use by controlling where use occurs, when use occurs, what type of use occurs, and how visitors behave.
- Modify the resource base by increasing resource durability or maintaining/rehabilitating the resource.
- Increase the supply of recreation opportunities.
- Reduce use in the entire area, or in problem areas only.
- Modify visitor attitudes and expectations."

Strategies included in the workbook include: site management, rationing and allocation, regulation, deterrence and enforcement, and visitor education.

The second half of the handbook describes specific treatments. The section on site management primarily addresses environmental impacts with recommendations for facility design to maximize compatibility with adjacent uses and other aesthetic qualities, as well as reducing conflicts between users, but it does not provide specific guidelines such as minimum widths or sight lines. Non-regulatory recommendations to reduce user conflicts include site management, rationing and allocation, deterrence and enforcement, and visitor education.

Site management strategies aim to "direct and channel use" and primarily address environmental concerns though resource hardening, increasing/decreasing the number of facilities, improving/not improving facilities, and closing areas. The authors state that curvilinear design "may be used to eliminate unacceptable impacts to visitor experience." One specific recommendation related to mitigating conflict issues is to use a rope or fence barrier to separate pedestrians travelling in different directions. Another is to provide additional trails to reduce congestion on popular trails.

Rationing strategies address localized visitor use problems and include limiting access via reservations, queuing (first-come first-serve) system, lotteries, merit/eligibility system, and charging fees. The majority of these refer to public versus private uses or reservation/permitting systems, which are less appropriate at for single-day use due to the work involved with issuance and enforcement. The authors note that sanctions can be effective, but at high cost to management. The authors also state that the management problem is often the distribution of recreationists, rather than the total number, so these strategies should be coupled with other management techniques.

Deterrence and enforcement strategies include providing signs, sanctioning visitors who engage in noncompliant behavior, and providing personnel and law enforcement. The authors recognize that, while signs are an important accompaniment to policies and education, success relies on user attention. They conclude that personnel and law enforcement can serve as an effective reminder of regulations.

The chapter on visitor education defines key conditions for visitor education to be effective: visitors must regard the behavior advocated by park managers as personally desirable and important messages must be communicated so they facilitate visitor acceptance. Education is more effective in combination with other tactics, and the authors state that, "educating visitors about appropriate behavior will be more effective when visitors: (1) are highly motivated to change their behavior to protect the biophysical environment, (2) are motivated to adjust their behavior so it better reflects values toward natural and cultural areas they already hold, and (3) understand the reason for the management action."

The section addressing regulation discourages managers from using regulation where effective non-regulatory alternatives exist. Regulatory strategies that can address user conflicts include the following:

- Restrict access to specific locations (zoning) – ensure that only regulations necessary to realize management goals are implemented.
- Restrict/prohibit activities – a highly obtrusive regulation that can "lead to a strong sense of 'being managed' on the part of the visitor which can lead to a climate of conflict.

Critique

Objectivity:	High	The Handbook was developed using extensive prior research by experts and professionals, and was field-tested for accuracy.
Thoroughness:	High	The Handbook covers a wide range of management practices, including site management, rationing and allocation, regulations, deterrence and enforcement, and visitor education.
Applicability:	High	The information presented in the Handbook is directly related to the CSP trail conditions and discusses management techniques on multi-use soft-surface trails.
Useful Information:	High	As outlined above, the information is quite helpful for developing recommendations regarding multi-use. A significant amount of this information was included in the findings.
Sustainability:	High	While the Handbook does not discuss design specifically, it notes key sustainability considerations in the site management section.
Keywords:	Problem definition (theoretical), trail layout/availability, education, user information, alternate use days, speed limits/citations	

Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers
Lessons Learned

Design Best Practices

- Consider using a rope or fence barrier to separate users travelling in different directions on an natural surface path.
- Use curvilinear design to minimize visitor impacts.

Management Best Practices

- Avoid restricting or prohibiting activities, as they are highly obtrusive regulations that can "lead to a strong sense of 'being managed' on the part of the visitor which can lead to a climate of conflict."
- Remind users of personnel and regulations with law enforcement.

Outreach Best Practices

- Communicate important messages so that visitors "(1) are highly motivated to change their behavior to protect the biophysical environment, (2) are motivated to adjust their behavior so it better reflects values toward natural and cultural areas they already hold, and (3) understand the reason for the management action."

- Target the message to the specific behavior that is the source of the unacceptable impacts, making clear what is or is not allowed, why the behavior is or is not allowed, and what, if any, the consequences are for noncompliance.

B.3.10 Trail Design Guidelines for Portland's Park System

City of Portland Parks & Recreation. 2009. atfiles.org/files/pdf/DesignGuidelinesPortland09.pdf

Background and Context

Design guidelines for Portland's trail system were developed by Portland Parks & Recreation (PP&R) in 2009 after the City's Parks 2020 Vision identified a lack of trail standards to be an issue.

Methodology

The guidelines are developed from PP&R's experience with the trail system in Portland, and included a list of contributors and reviewers.

Findings

The first issue considered in the guidelines' design philosophy is safety. While the discussion primarily addresses user separation from motor vehicles, it also notes that different trail users may travel at differing speeds. Accessibility is another design philosophy, which highlights PP&R's desire to provide trails at a range of challenge levels. The guidelines recommend public process and review by the Portland Citizens' Disability Advisory Committee (PDAC) to determine what level of accessibility a given trail should provide.

The guidelines provide design and use standards for all types of single use trails, as well as multi-use trails. The trail type pertinent to this Study is Type J: hiking/mountain biking trails (equestrian use is allowed). The guidelines clarify the equestrians and dog walkers are minor uses on hiking/mountain biking trails, while mountain bikers are not allowed on hiking/equestrian trails. Mountain bikers, equestrians, and hikers are also allowed on fire roads or wider gravel trails.

Hiking/mountain biking trails/equestrian trails should be 4 feet wide with passing areas at a minimum, 10 feet maximum width. The easement width should be 10 feet in addition to the tread width. Native herbaceous plants can be allowed to revegetate all but the trail bed. The discussion noted that these widths allow side-by-side hiking or riding, or room for on-coming or overtaking trail users. Grades should be 0 to 5 percent slope or up to 12 percent as needed, but the trail does not have the obstacles desired by expert riders. These trails should be ADA-accessible, although the surface is not reliably firm and slip resistant. Sight distance should be 40 to 100 feet, "depending on speed/flow," and turn radii should be 10 feet minimum. The guidance also recommends retaining large stable round rocks at the surface of the trailhead, while removing pointed or loose stones.

Hiking and equestrian trails are designed for single-file walking, running, and horse riding. Dogs must be on leash. Trail width should be 4 to 10 feet with an additional 10 feet for the easement. Standard grades are 0-12 percent slope (5 percent maximum preferred). Sight distance is 50 to 100 feet and turning radius guidance is to "avoid sharp turns." In addition, the guidance states that, "Bicycles are specifically not allowed in order to not startle more nervous horses."

Critique

Objectivity:	High	The book is a detailed design guide for Portland, developed by staff with contributions from several other agencies.
Thoroughness:	High	PP&R has the most nuanced trail classification system included in this Literature Review, and discusses appropriate design and considerations for each type.
Applicability:	High	The Type J: Hiking/mountain biking trails where equestrians are allowed include all users and the conditions addressed in this Study.
Useful Information:	High	The Guidelines present specific, measurable standards for multi-use trails, which inform the findings and recommendations of this Study.
Sustainability:	High	PP&R includes a section discussing design for sustainability, and includes these considerations in the appropriate design for each trail type.
Keywords:	Design guidelines, width/passing areas, gradient, design speed, trail layout/availability, sight lines	

Trail Design Guidelines for Portland's Park System **Lessons Learned**

Design Best Practices

- Hiking/mountain biking trails (equestrians permitted) should be 4 feet wide with passing areas at a minimum, 10 feet maximum width. Hiking/equestrian trails (mountain bikers prohibited) should be 4 to 10 feet wide with an additional 10 feet for the easement.
- Provide 10 feet easement width in addition to the tread width and allow native herbaceous plants to revegetate all but the trail bed.
- Sight distance on a hiking / mountain biking trail should be 40 to 100 feet, "depending on speed/flow," and on a hiking/equestrian trail is 50 to 100 feet.
- Hiking/MTB Grades should be 0-5 percent slope or up to 12 percent as needed, but the trail does not have the obstacles desired by expert riders. Hiking/equestrian Standard grades are 0-12 percent slope (5 percent maximum preferred).
- Turn radii on a hiking/mountain biking trail should be 10 feet minimum and on a hiking/equestrian trail should "avoid sharp turns."
- Hiking/mountain biking trails should be ADA-accessible, although the surface is not reliably firm and slip resistant. Hiking/equestrian trails are not accessible.

B.3.11 Narrow Natural Surface Trails: Managing Multiple Users

East Bay Regional Parks District. 2011.
http://www.ebparks.org/files/ebrpd_Narrow_Trail_Study_FINAL_03_24_2011.pdf

Background and Context

This 2011 study from the East Bay Regional Parks District (EBPRD) identifies and discusses specific management approaches for narrow natural surface trails in the San Francisco Bay Area.

Methodology

The study includes a survey of 15 park and open space management agencies requesting information on their agency's trail use practices, planning policies, environmental review, maintenance activities and enforcement practices.

Findings

The executive summary states the following general consensus findings:

- "Trails designed with multiple use in mind are more successful in accommodating multiple uses, such as hiking, equestrians and bicycling than trying to adapt existing trails for multiple use.
- Designating allowable uses when a trail is initially constructed and opened is more successful in gaining public acceptance that initiating use changes over time, especially in popular parks where existing use patterns are well established.
- Providing regulatory information simultaneously multiple ways through park signage, a web site and staff and volunteer presence serve as the most effective way to reach out and inform trail users.
- Fewer regulations consistently applied and enforced yields greatest compliance."

The survey was an in-depth analysis of park and open space managers' experience with managing multiple uses on narrow natural surface trails. The 15 agencies surveyed by EBRPD have differing standards for narrow natural surface trails, shown in Table B-2.

Table B-2. Agency Definition of Narrow Multi-Use Trails

From *Narrow Natural Surface Trails: Managing Multiple Users* (EBRPD, 2011)

Agency	Agency Definition of Narrow Trails
Marin County Open Space District	3 to 3.5 feet wide with 8 feet of lateral clearance
Midpeninsula Regional Open Space District	6 to 10 feet wide (Class A, widest) 4 to 6 feet wide (Class B, intermediate) 2 to 4 feet wide (Class C, narrowest classification)
Santa Clara County Parks and Recreation Department	4 to 6 foot wide (narrow trails limited to mountain areas)
California State Parks	Less than 60 inches wide (Roads are defined as greater than 60 inches)
East Bay Regional Park District	Less than 8 feet wide

Agencies employ a variety of techniques to manage users on narrow natural surface trails. Key findings are summarized in Table B-3. In addition to these, the survey found that, "Participating managers surveyed noted that some of the strategies being used, especially those intended to control speed (e.g., pinch points, uneven surfaces), may render the trail less accessible to those with mobility impairments." Agencies must balance providing facilities that are suitable for all users.

Table B-3. Findings –Summary of Managers' Survey Findings, *Narrow Natural Surface Trails: Managing Multiple Users* (EBRPD, 2011)

Tool	Strategies that have been successful with participating agencies	Strategies that have created management challenges for participating agencies
Design	Moderate grades Good sightlines Bench width Grade reversals Features to minimize conflict	Combining use on trails not designed for multiple use Design that benefits one user can be an obstacle to another Encouraging speed differential with sustained steep grades
Use Distinctions	Multi-use from day one Plan out uses before opening Design for multi-use intent Construct and restore the land before opening Create opportunity for cooperative use Separate users: Separate by park Separate at trailheads Separate by trail	Combining uses on crowded trails More challenging to safely manage many different uses where use is high Every potential conflict is magnified High use areas require user limitations
Signage	Regulatory/wayfinding signage that clearly communicates What is an official trail and what is not? What people need to know in order to comply What people need to know to recreate at a comfortable skill, mobility level	Lack of signage Leads to confusion Lack of information on conditions can create poor or dangerous trail experiences Add to misuse of existing trails, use of bootleg trails
Enforcement	Consistent enforcement Regulatory compliance on trails requires consistent enforcement This does not come for free Communicate/educate through enforcement	Complex regulations Uphill only One way loop Alternate day Inconsistent Enforcement Low commitment equals limited effectiveness People will do what they think they can get away with People are angry with inconsistency Self Regulation Dependent on a small and local user group Ownership is key, fee and membership base Generally not effective in publicly-managed park lands

The study also addresses outreach and education techniques, noting the difficulty with assessment of these strategies; "The success of outreach and educational programs in promoting compliance with trail use policies varies considerably across the region with no obvious factors determining the difference between success and failure." Nevertheless, several agencies cited education and outreach techniques that they had found to have a positive impact. Examples include the Marin County Open Space District's sponsorship of mountain biking races and running and mountain biking user groups' use of EBPRD's trails for training.

While the survey only briefly addresses environmental impacts of mountain bikes, it does include consideration of management strategies directed at minimizing those impacts.

Critique

Objectivity:	High	The conclusions in this report directly based on findings from a survey of parks districts.
Thoroughness:	Medium	This study presents the results of the survey, including management strategies for multi-use. It does not discuss specific, measurable designs.
Applicability:	High	The study focuses on trail agencies that manage narrow natural surface trails that accommodate a variety of users, similar to the situation considered in this Study.
Useful Information:	High	While the study provides limited design for multi-use, it presents management and outreach best practices that inform this Study.
Sustainability:	Medium	The study discusses resource considerations for allowing multiple uses, but does not link sustainability with appropriate multi-use trail design.
Keywords:	Problem definition (general), design guidelines, width/passing areas, speed treatments, education, events, user group meetings, user information, enforcement	

***Narrow Natural Surface Trails* Lessons Learned**

Design Best Practices

- Provide moderate grades, good sightlines, a wide bench, grade reversals, and features to minimize conflicts.

Management Best Practices

- When possible, plan for multiple uses when trail is being developed and planned.
- Separate users by park, trail, or trailhead.
- Use regulatory and wayfinding signs that communication regulations and skill level expectations.
- Consistently enforce trail rules; educate users through enforcement.

Outreach Best Practices

- Monitor blogs and e-mail list serves.
- Actively connect with trail users through organized activities and leagues.
- Coordinate with other agencies, non-profit organizations, schools and volunteers.
- Partner with youth-oriented organizations to reach out to younger trail users.

B.3.12 The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines

Hendricks, W., R. H. Ramthun, and D. J. Chavez. 2001. Journal of Park and Recreation Administration 19(3): 38-61.

Background and Context

This study was co-authored by a professor with the Recreation Administration Program, Natural Resources Management Department at California Polytechnic State University (Hendricks), a professor with Tourism

Industry Management at Concord College (Ramthun), and a research social scientist with the USDA Forest Service (Chavez).

Methodology

The study was conducted in the Marin Municipal Water District (MMWD), on fire roads on Mt. Tamalpais where bicycling is allowed. At the time of the study, MMWD enforced a 15 mph speed limit on all trails and a 5 mph speed limit when passing others and on blind curves. The fine for speeding was $200, while the fine for riding on single-track where mountain biking is prohibited was $125.

The study tested three main factors: mountain bikers' behaviors, message content, and message source as shown in Table B-4.

Table B-4. Matrix of Variables Tested, Hendricks et. al., 2001

Behaviors Tested[i]	Message Content Tested	Message Sources Tested
• Bicyclists' yielding behavior when approaching hikers • Bikers' speeds • Bikers' actions when approaching an area where biking was prohibited • Bikers' behavior at stream crossings	• 'Moral appeals' to protect the natural resources and enhance other users' safety • 'Fear appeals' that identified consequences.	• Uniformed agency volunteer • Hiker • Biker

[i] Yielding was rated on a 10-point scale by trained researchers, while speed was tested with a hidden radar gun and behaviors categorized into 'compliance' and 'non-compliance.'

Findings

For yielding behavior, the study found that the source of the appeal (uniformed agency volunteer, hiker or biker) did not make a difference, but the fear appeal resulted in stronger yielding behavior than the moral appeal or the control. On the other hand, neither message source nor content had a significant impact on mountain bikers' speeds. Mountain bikers given an appeal message from a volunteer hiker were found to be more likely to dismount when approaching an area where mountain biking was prohibited (although compliance remained below 40 percent in all cases), while the fear appeal was more likely to result in bikers dismounting to cross the stream. In all four behaviors, the uniformed volunteer was less effective in gaining compliance than the volunteer mountain biker or hiker.

The authors conclude that any type of message is better than no message at all. In addition, they postulate that, because mountain bikers were not aware their speeds were being measured, they had less incentive to comply with regulations given a threat of the consequences. The authors conclude that, "volunteer mountain bike patrols, such as those organized and trained by IMBA's National Mountain Bike Patrol, have the potential to be an effective mechanism for influencing behavior of bicyclists."

Critique

Objectivity:	High	This article uses data collected by MMWD and was authored by professors and peer-reviewed.
Thoroughness:	High	While the article discusses a single specific topic (trail signage), it goes into significant detail regarding analysis and recommendations.
Applicability:	High	The study considers mountain bikers' compliance with signage on multi-use trails, which is directly relevant to the subject of this Study.
Useful Information:	High	The study's conclusions are highly pertinent to this Study, and relevant information is included in the findings and the recommendations.
Sustainability:	Low	The article does not address sustainability.
Keywords:	Problem definition (general), education, volunteer programs, user information	

***The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines* Lessons Learned**

Management Best Practices

- Use volunteer hikers or mountain bikers to encourage good behaviors on trails.
- When using a threat of enforcement message, enforce with visible presence of rangers or volunteer patrols.

B.3.13 Emerging Principles for Using Information/Education in Wilderness Management

Manning, R. 2003. International Journal of Wilderness 9: 20-27, 12.http://ijw.org/wp-content/uploads/2003/12/Vol-09.No-1.Apr-03small.pdf

Background and Context

Manning is a professor of Natural Resources and Director of the Park Studies Lab at the University of Vermont. He worked with the Park Service and has authored several publications on the subject of trail use, including *Parks and Carrying Capacity: Commons without Tragedy*. Published in the International Journal of Wilderness, this is peer-reviewed article.

Methodology

This article is a conceptual review of literature that suggests the potential effectiveness of information and education on five types of problem behaviors of wilderness visitors (illegal, careless, unskilled, uninformed, and unavoidable actions).

Findings

Manning found that information and education has limited effectiveness in deterring deliberately illegal or unavoidable problem behaviors, while it can be effective at reducing careless, unskilled, or uninformed actions. This conclusion supports this Study's recommendation to address user conflict through a variety of avenues, including information, enforcement, and outreach.

The article defines several empirical studies that have analyzed the effectiveness of information and education programs. Studies that have focused on enhancing visitor knowledge to reduce ecological and social impacts have not found trailhead signs and brochures to be very effective, while workshops and special programs can enhance knowledge levels. Studies focusing on visitor attitudes toward management policies have found that information/education "can be effective in modifying visitor attitudes so they are more supportive of wilderness and related land management policies." Finally, studies focused on depreciative behavior (such as littering or vandalism) have found that education (a brochure and a personal contact) can be a successful deterrent to littering. While not directly related to user conflict, this finding supports the use of signs to encourage good user behaviors in a variety of contexts.

Manning concludes with a series of 'emerging principles' for information and education programs, as paraphrased in the table below.

Critique

Objectivity:	High	This article cites other empirical studies and was authored by professors and peer-reviewed.
Thoroughness:	High	Manning considers a range of studies that considered the use of information in a variety of backcountry settings.
Applicability:	High	This article addresses how visitors respond to user information and education of similar types being considered in this Study.
Useful Information:	Med	Some of the information presented in the article is not directly pertinent to user conflicts on soft-surface trails, although it informs the types of management out outreach strategies used to modify user behavior.
Sustainability:	Low	The article does not address sustainability.
Keywords:	User information	

Emerging Principles for Using Information/Education in Wilderness Management **Lessons Learned**

Outreach Best Practices

- Maximize efficacy by addressing problem behaviors that are characterized by careless, unskilled, or uninformed actions.
- Connect with or modify visitor attitudes, beliefs, or norms and provide information on the impacts, costs, and consequences of problem behaviors.
- Deliver messages via multiple media, including brochures, personal messages, audiovisual programs, newspapers, magazines, guidebooks, trained volunteers, outfitters, commercial guides, wilderness ranger and volunteer role modeling.
- Design materials for a variety of target audiences and deliver messages in several locations.

B.3.14 Safety Considerations for Multi-Use Trails

California Equestrian Trails and Land Coalition. 2005.
http://www.calequestriancoalition.com/FinalVerCETLCSafetyGuides.htm

Background and Context

This 2005 publication by the California Equestrian Trails and Land Coalition (CET&LC) recommends design standards and safety guidelines to safely accommodate bicyclists, equestrians, and hikers on the same trail.

Methodology

The CET&LC recommends specific trail standards that provide visibility, width, slope, and separation to accommodate a variety of user types. The report does not state what data the conclusions are based on.

Findings

CET&LC states that mountain bicycling use has become a safety issue for equestrians, particularly due to the speed differential with other users; most users travel at 4 to 5 mph while mountain bicyclists frequently travel at faster speeds.

They do not make specific recommendations about trail widths, but note that wide trails can create maintenance and drainage problems. CET&LC states that, "Forest Service believes bikers and equestrians will often ride side by side if the trail is too wide, while many equestrians consider a 6-foot wide trail as a minimum in order to safely pass cyclists" while travelling in opposite directions.

If the trail cannot be built to these standards, they recommend it not be opened to multiple user types. They also recommend education of trail users, including training equestrians to minimize their horses' 'startle factor,' as well as etiquette signage and enforcing trail rules.

Critique

Objectivity:	Med	The authors do not cite what the recommendations are based on, aside from user experience on multi-use trails.
Thoroughness:	Med	CET&LC makes recommendations regarding guidelines for appropriate trail use, management, and outreach strategies, but do not provide background for the recommendations.
Applicability:	High	The recommendations are directly targeted to reducing conflicts on multi-use trails.
Useful Information:	High	The information is a good resource for appropriate trail design.
Sustainability:	Med	CET&LC mention sustainability concerns, but do not link them to appropriate trail design.
Keywords:	Problem definition (general), design guidelines, width/passing areas, design speed, education, user information, enforcement	

***Safety Considerations for Multi-Use Trails* Lessons Learned**

Design Best Practices

- Switchbacks and curves need 50 feet if visual clearance on either side so users can see others.
- Avoid wide trails to minimize erosion, but provide sufficient space for users to pass each other.
- Keep slope as low as possible (less than 12 percent if possible) for safe places for passing and visibility.
- Where terrain is steep, visibility is limited, and there is insufficient space for users to pass each other, consider having separate parallel trails for different user types.

Management Best Practices

- Use the triangle yield sign at trailheads of all multi-use trails.
- Enforce trail rules via law enforcement as well as volunteer patrols.

Outreach Best Practices

- Educate users about the “startle factor” of horses.
- Hold training clinics for equestrians to each the horses and riders to meet cyclists in varying situations.

B.3.15 Trail Solutions: IMBA's Guide to Building Sweet Single-Track

International Mountain Bike Association. 2004. Boulder, CO: International Mountain Bicycling Association.

Background and Context

The International Mountain Bicycling Association (IMBA) is a worldwide group of individuals, clubs, and organizations focused on advancing and supporting opportunities for mountain biking to grow. The book was edited by IMBA’s director of special projects, Pete Webber, who also edited *Trail Solutions: IMBA's Guide to Building Sweet Single-Track.* Several agencies surveyed reported that they use this book as a guidance document for developing single-track trails, including North Carolina Division of Parks and Recreation; Wake County, NC; and Durango, CO.

Methodology

This book is a guide to establishing single-track trails and includes topics on building partnerships, writing proposals, management strategies, and trail design guidelines. The book presents two methods to develop multi-use trails: user etiquette and trail design. The recommendations come from expert and professional opinion of trail builders, as well as case studies.

Findings

One of IMBA's "Rules of the Trail" is the precept to 'Always Yield the Trail'. From the rules: "Let your fellow trail users know you're coming. A friendly greeting or bell is considerate and works well. Anticipate other trail users around corners or in blind spots. Show your respect when passing others on the trail by slowing to a walking pace or even stopping. Yielding means slowing down, establishing communication, and being prepared to stop if necessary in order to pass safely." The book explains that user conflicts can be mitigated by following basic trail etiquette.

The book includes discussion of multi-use trails and single-use trails from a perspective of managing user conflict. The authors disagree with the notion that separating users is the best strategy to manage conflict and contend that responsible bike use is compatible with most other types of trail use. The book advocates against single-use trails from the belief that they concentrate users and increase the negative impacts of crowding, as well as the negative environmental issues of providing sufficient trail mileage for all user types. The authors do acknowledge that single-use trails can be useful for reducing user conflict in certain situations including very crowded trails, high-speed trails, challenge parks, and secluded nature trails.

Single direction trails are another strategy for reducing user conflict mentioned by the authors. They state that single direction trails can manage conflict through alleviating congestion, providing a more predictable experience, and reducing the number of passes between users. Direction restrictions may be combined with user group restrictions, such as day/time restrictions, or applied to one user group. For instance, a trail network may require mountain bikers to use trails, during allowed hours, in one direction while hikers may be allowed to travel in either direction."

IMBA frames single-track trails as a tool for speed management of mountain bikers and implies that wider trail widths increase mountain bike speeds and have the potential to increase user-conflicts. Narrow and rough trails are said to encourage focused and slower speeds of travel, and promote safe sharing of the trail space. The guide generally recommends that pinch points to slightly narrow the trail be installed just prior to areas where users should slow down. In addition, anchors in the form of large rocks or objects, can be staggered on the sides of the trail to slow users. The simple suggestions and guidelines presented here are based on extensive experience, although limited in scope to single-track trails.

Critique

Objectivity:	Med	The IMBA guide was developed with input from numerous individuals that professionally manage and build trails. However, being authored by a mountain biking organization, the authors are interested in promoting mountain bicycling.
Thoroughness:	Med	This book primarily focuses on the planning and design of single track trails, but does include guidance for using design and separate trails to minimize trail user conflicts and safety issues.
Applicability:	High	The IMBA guidance is highly applicable to the CSP setting, as mountain bikes are one of the primary additional uses being considered. The guide does, however, focus on a specific type of soft-surfaced trail: singletrack.
Useful Information:	High	This resource provides very specific guidance for planning and designing mountain bike trails, including design elements for minimizing conflict and safety issues.

Sustainability:	Med	The IMBA guide includes an entire section dedicated to 'The Principles of Sustainable Trails.' The guidance primarily focuses on the aspect of sustainability related to minimizing trail erosion.
Keywords:	Problem definition (general, design guidance, , width/passing areas, gradient, design treatments, trail layout/availability, education, user group notification, volunteer programs, events, user group meetings, public notification, ranger patrol, user information, speed limit/citations, enforcement	

***Trail Solutions: IMBA's Guide to Building Sweet Single-Track* Lessons Learned**

Design Best Practices

- Use single-track trails over wider trails to reduce mountain bike speeds.
- Pinch points to slightly narrow the trail should be installed just prior to the area where users should slow down.
- Anchors, in the form of large rocks or objects, can be staggered on the sides of the trail to slow users.

B.3.16 Managing Mountain Biking: IMBA's Guide to Providing Great Riding

International Mountain Bike Association. 2007. Boulder, CO: International Mountain Bicycling Association.

Background and Context

IMBA's guidebook on managing trails was produced in cooperation with the Recreational Trails Program of the Federal Highway Administration. It was edited by Pete Webber, IMBA's Director of Special Projects and includes contributions from FHWA's Recreational Trails Program, Pennsylvania Department of Conservation and Natural Resources, Tennessee Department of Environment and Conservation, Minnesota Department of Natural Resources, Trails and Waterways Division, and the U.S. National Park Service Rivers, Trails, and Conservation Assistance Program. Several agencies contacted in the survey for the current study noted they have used this resource to design trails and manage user conflict including California State Parks Santa Cruz District; the Hill Country Conservancy, TX; Mecklenburg County, NC; Wake County, NC; Lake Norman State Park, NC,; and City of Durango, CO.

Methodology

Similarly to *Trail Solutions: IMBA's Guide to Building Sweet Single-Track*, this resource uses information from case studies and from the long list of contributors. The recommendations are not tied directly to the source of the information.

Findings

The guide begins with the preface that, "When trails are well-designed and visitors observe basic trail etiquette, most people, whatever their means of conveyance, will have a satisfying experience on shared trails." Nevertheless, IMBA lists situations where separating users may be advised:

- Crowded trails – to avoid congestion.

- Crowded trailheads – to provide dedicated parking facilities.
- Extraordinary mountain biking trails – trails designed exclusively for mountain biking.
- High-speed trails – trails designated for race-training or use by expert-level users.
- Bike parks – trails for riders to hone mountain biking skills.
- Nature trails – trails that provide seclusion for hikers or that are ADA-accessible.

The section entitled, "Should an existing trail be open to Mountain Bikers?" lists questions designed to assist managers in determining allowable uses. Questions that pertain to conflict issues include the following:

- Will the pre-existing uses mesh with mountain biking?
- Does the trail have a sustainable alignment?
- Could the trail be altered to have a more sustainable alignment?
- Will the trail meet local needs?
- What kind of trails do local cyclists seek?
- Would mountain bikers like to ride the trail?
- Are resources available to meet maintenance needs that may arise with increased use?
- Is there a local bike club available and willing to support the trail?

The guide also recommends ways of managing conflict and safety issues on shared trails including trail design, information and education, regulations, and user involvement and partnerships. Information and education include share the trail signs, as well as paid staff patrols, volunteer patrols, peer education, clinics, and handouts. The guide notes that volunteer patrols are a "tangible reminder that mountain bikers are aware of their potential effect on other visitors, are committed to regulating themselves, and are willing to give back to the trails in the form of volunteerism." IMBA discourages the use of speed limits, stating that "speed limits are extremely difficult to enforce, may be unreasonable for trails with constantly changing terrain, probably won't improve real or perceived safety on the trail, and can damage essential respect and trust."

The authors recommend that designing a trail to reduce conflict and safety issues and be sustainable requires consideration of the trail flow, or the rhythm of the trail as "determined by the landscape and sequence of terrain." Trail anchors can include large rocks, logs, trees or other obstacles that act as a visual and physical barrier showing where the trail is and requiring users to slow down to pass. Choke points are rocks or a broken tree trunk that acts as a gateway through which trail users must pass. IMBA recommends providing sufficient sight distance for users to see the obstacle and slow down in advance of the feature. Uneven surfacing can also encourage users to slow down and trail hardening is recommended for sustainability in difficult locations. Bermed turns and consistent flow are recommended to minimize soil disruption. However, part of the benefit of these elements is that they allow mountain bikers to turn without slowing down.

The chapter about partnerships highlights the importance of soliciting input from proposed user groups. Recommendations include writing specific agreements to define roles and responsibilities, starting simple and building as the relationship develops, and creating a plan for ongoing communication with the group. Some of the guidance is directed at trail managers, while other guidance is intended for use by advocates and trail user groups. For example, the chapter on managing volunteers is directed at a new club or organization. IMBA also recommends forming a Trail Advisory Group to mitigate conflict. Additional partnership solutions include forming user group coalitions, holding volunteer trail work days, and organizing multi-use events.

Critique

Objectivity:	Med	While the book was published through five public agencies, it does not provide information about the contributors' backgrounds. The guidelines are based on a series of case studies and professional experience of the authors.
Thoroughness:	Med	This book focuses primarily on management and outreach, as well as designs to address conflicts, although it does not provide measurable guidelines for the appropriate design of multi-use paths.
Applicability:	High	The topics discussed in this book directly discuss management strategies for user conflict and are therefore highly applicable.
Useful Information:	High	This resource has significant information informing the Study, which is included and cited in the findings and the recommendations.
Sustainability:	Med	The chapter, "Mountain Biking and the Environment" discusses mountain bikers' impacts to the trail surface
Keywords:	Problem definition (general), design guidelines, speed treatments, trail layout/availability, user information, designated use-intensive	

***Managing Mountain Biking* Lessons Learned**

Design Best Practices

- Use trail anchors as visual barriers showing where the trail is and requiring users to slow down to pass.
- Create choke points through which trail users must pass.
- Provide sufficient sight distance for users to see the obstacle and slow down in advance of the feature.
- Use uneven surfacing to encourage users to slow down and for sustainability.
- Use stacked loops that require mountain bikers to travel further to access more technical riding areas while hikers and families have trails near parking.
- Place trail crossings at the top of a small rise or place rocks to encourage users to slow down in advance of an intersection.

Management Best Practices

- Use management strategies, including share the trail signs, paid staff patrols, volunteer patrols, peer education, clinics, and handouts.
- Provide adequate trail opportunities and diverse trail experiences.
- Designate one-way loops to reduce passing events.

Outreach Best Practices

- Write specific agreements with user groups to define roles and responsibilities; start simple and build as the relationship develops; and create a plan for ongoing communication with the group.
- Form a Trail Advisory Group to identify and solve user conflicts before they become serious problems.
- Hold 'Romp and Stop' events where mountain bikers and equestrians get together and "ride each others' steeds."

Table B-5. Summary of Key Literature Review Resources

					Problem Definition					Design					Management					Outreach					Critique				
Author	*Title*	Year	Journal/ Citation	Agency/ Affiliation	General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
Chavez, D. J.	*Mountain Biking: Issues and Actions for USDA Forest Service Managers*	1996a	Res. Paper PSW-RP-226-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.	US Forest Service			x									x	x				x	x	x	x	High	High	High	Med	Low
Hesselbarth, W., B. Vachowski, M. Davies	*Trail Construction and Maintenance Notebook*	2007	FHWA and United States Forest Service, FSH2309.18	US Forest Service						x					x										High	Low	Low	Low	Low
Moore, R. L.	*Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*	1994		FHWA		x									x					x	x	x	x	x	High	High	High	High	Low
National Park Service, Department of the Interior	*Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona*	2003		National Park Service					x																High	High	High	High	Low
United States Department of Agriculture Forest Service	*Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds*	2007	0723-2816-MTDC	In cooperation with FHWA	x					x	x														High	High	High	High	Low
Flink, C., Olka, K., Searns, R., Rails-to-Trails Conservancy	*Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails*	1993	Washington, D.C.: Island Press.	Island Press	x					x	x					x	x			x					High	High	Low	Low	Low
MN Dept of Natural Resources	*Trail Planning, Design, and Development Guidelines*	2006	St. Paul, MN: State of Minnesota.	MN Dept of Natural Resources	x					x		x			x										High	High	High	High	High
North Carolina Division of Parks and Recreation	*Results of the Two Year Mountain Bicycle Trail Study*	1993	North Carolina Division of Parks and Recreation, Department of Environment, Health and Natural Resources						x	x					x										High	High	Med	Low	High
Bondurant, J., L.Thompson et. al.	*Trail Planning for California Communities*	2009	Solano Press Books		x					x	x	x			x										High	High	High	Med	Med

					Problem Definition					Design					Management					Outreach					Critique				
Author	***Title***	**Year**	**Journal/ Citation**	**Agency/ Affiliation**	**General**	**Theoretical**	**Manager Survey**	**User Survey**	**Incident/Complaint Data**	**Width/Passing Areas**	**Sight Distance**	**Gradient**	**Speed Control Features**	**Curvilinear Design**	**User Information**	**Enforcement**	**Rules & Regulations**	**Public Notification**	**Data Collection**	**Education**	**User Group Meetings**	**Volunteer Programs**	**User Group Notification**	**Events**	**Objectivity**	**Thoroughness**	**Applicability**	**Useful Info**	**Sustainability**
Anderson, D.H., Lime, D. W., and T.L. Wang	*Maintaining the Quality of Park Resources and Visitor Experiences*	1998	St. Paul: University of Minnesota Extension Service.	University of Minnesota		x									x	x	x			x					High	High	High	High	High
City of Portland Parks & Recreation	*Trail Design Guidelines for Portland's Park System*	2009		City of Portland, OR						x	x	x													High	High	High	High	High
East Bay Regional Parks District (EBPRD)	*Narrow Natural Surface Trails Managing Multiple Use*	2011			x					x				x	x	x				x	x			x	High	Me d	High	High	Low
Hendricks, W., R. H. Ramthun, and D. J. Chavez	*The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines*	2001	Journal of Park and Recreation Administration 19(3): 38-61	California Polytechnic State University, Concord College , USDA Forest Service				x							x					x		x			High	High	High	High	Low
Manning, R. E.	*Emerging Principles for Using Information/Education in Wilderness Management*	2003	International Journal of Wilderness 9: 20-27, 12.												x										High	High	Med	High	Low
California Equestrian Trails & Lands Coalition	*Safety Considerations for Multi-use Trails*	2005	NOP Comment Letter O-5, p. 82	California Equestrian Trails & Lands Coalition	x					x					x	x				x					Low	Low	High	High	Low
IMBA	*Trail Solutions: IMBA's Guide to Building Sweet Single-track*	2004	Boulder, CO: International Mountain Bicycling Association.	International Mountain Bike Association	x								x	x	x										Med	Med	High	High	Med
IMBA	*Managing mountain biking: IMBA's guide to providing great riding*	2007	Boulder, CO: International Mountain Bicycling Association.	International Mountain Bike Association	x					x		x	x	x	x	x	x	x		x	x	x	x		Med	Med	High	High	Med

Appendix C. Agency Survey

This chapter presents the results of the Agency Survey (survey). The goal of the survey was to collect information on the practices, standards (if available), and opinions of agency staff and in a few cases organization representatives, with significant experience managing unpaved shared-use trails in the U.S. and Canada. The survey was conducted in March, April and May of 2011. The goal of the survey was to determine trail managers' informed opinions and experiences of user conflict and what actions they have taken to address these issues. This information supports the Literature Review by identifying issues and solutions that may not be captured in written documents or that may be the result of experience in the field.

The first section of this appendix presents the survey methodology and agency selection process. The second section presents a "lessons learned" review of the key findings collected from this survey. The appendix closes with a summary of the information collected from key agencies.

C.1 Methodology

The survey instrument asked questions about the nature of trail user conflicts, including which groups are involved in conflicts, what common complaints are heard, how frequently incidents or complaints occur, and what other characteristics or features exist in locations where conflicts occur. Managers were also asked about solutions they had employed, including design and management strategies to address these issues. The survey also requested ay available incident or complaint data, as well as any design guidelines or policies used by the agency.

To gather the best information related to user conflicts on trails in a short timeframe, the survey form was updated based on feedback from early participants. An initial survey form was developed and sent to a preliminary set of agencies, then reviewed and revised based on the feedback about the clarity of the questions. The final survey form is provided in Appendix F.

Prior to e-mailing the survey, Alta staff filled in basic information about the agencies, recording the size of the agency and identifying available design or management documents. As surveys were returned, staff followed up with each agency to collect relevant data or reports, if available, or to determine that that information was not available from the agency. The objective was to collect data and documents to back up opinions and clarify practices.

C.1.1 Agencies Surveyed

The agency contact list was initially developed based on State Parks staff suggestions and included several agencies known to have dealt with trail user conflicts. The survey was also sent to all State Parks districts. In addition, a user group study notice was developed to solicit additional contacts and resources for the Literature Review. The notice is provided in Appendix D and was shared with trail user groups.

Surveys were sent to 52 agencies and State Parks Districts. Thirty-six surveys were returned. The breakdown of the agencies who returned surveys is shown in Table C-1.

Appendix C.

Table C-1. Agencies Surveyed

Agency	Type	State	Park Acreage	Trail Mileage
Bureau of Reclamation, Lower Colorado Region	Federal	CO	120,000	120
U.S. Forest Service, Lake Tahoe Basin Management Unit	Federal	CA/NV	160,000	415
Calaveras Sector, State Parks	CA State Park	CA	252	0.5
Columbia State Historic Park	CA State Park	CA	6,500	15
Colorado Desert District, State Parks	CA State Park	CA	700,000+	200
Four Rivers Sector, State Parks	CA State Park	CA	37,000	45
Gavilan Sector, State Parks	CA State Park	CA	87,000	363
Gold Fields District, State Parks	CA State Park	CA	46,000	218
San Joaquin Sector, State Parks	CA State Park	CA	12,520	16
Santa Cruz District, State Parks	CA State Park	CA	N/A	262
Topanga Sector, State Parks	CA State Park	CA	11,000	36
Turlock Lake SRA/Caswell Memorial SP/Bethany Reservoir	CA State Park	CA	533	3
North Carolina Division of Parks and Recreation - Lake Norman State Park	State Park	NC	N/A	25
Oregon Parks and Recreation	State Park	OR	102,500	960
Capital Regional District Parks	Regional	BC	28,400	50
Conejo Open Space Trails Conservation Agency	Regional	CA	11,300	140
Front Country Trails Multi-Jurisdictional Task Force	Regional	CA	N/A	30
Hill Country Conservancy	Regional	TX	N/A	100+
Tualatin Hills Park and Recreation District	Regional	OR	1,300	60
Vancouver-Clark Parks and Recreation	Regional	WA	7,000	44
Jefferson County Open Space	County	CO	39,000	204
Mecklenburg County Park and Recreation	County	NC	18,800	113
Sacramento County Regional Parks, Recreation & Open Space	County	CA	15,000	23
San Luis Obispo County	County	CA	15,000	52
Santa Clara County Parks and Recreation	County	CA	45,000	300
Wake County Parks, Recreation and Open Space	County	NC	250	14
Town of Crested Butte	City	CO	N/A	20
City of Durango	City	CO	2,531	95
City of Henderson	City	NV	N/A	N/A
Town of Pagosa Springs	City	CO	200	6
City of Palo Alto Open Space & Parks	City	CA	4500	45
Portland Parks and Recreation	City	OR	11,000	220

Agency	Type	State	Park Acreage	Trail Mileage
San Luis Obispo	City	CA	4,000	41
City of Las Vegas	City	NV	N/A	51
Forest Park Conservancy	Non-profit	OR	5,100	80+
Pacific Crest Trails Association	Non-profit	CA, OR, WA	N/A	2650

In addition to the agencies listed above, the Monterey, Asilomar, Big Sur, and Refugio Sectors of California State Parks reported that they receive too few complaints to justify completing the survey.

C.2 Summary of Key Survey Findings

Several key themes and successful strategies emerged from the Agency Survey. This section summarizes the information received by topic, first discussing the problem definition, then solutions that were proposed by agency representatives, including safe trail design, and management/outreach solutions. The survey questions were open-ended, to encourage agency representatives to provide feedback without leading them toward specific responses. However, this technique resulted in many different responses. The Planning Team categorized these responses to the extent possible, but a certain amount of interpretation was required.

In addition, some of the data does not directly pertain to this Study. In particular, surveys frequently cited issues with bicyclist speeds on paved trails, issues with dogs, and concerns about managing other power driven mobility devices (OPDMDs). These concerns are noted in the appropriate sections below, but the Project Team did not follow up on these issues, and the lessons learned focuses on information relevant to the Change-In-Use Process.

In the following summary findings, where a theme was cited by a single source or multiple agency or document sources, the reference follows. Where jurisdictions are cited without a date, the source is that jurisdiction's Agency Survey. If several sources supported the finding, the text provides general reference to support without specifically identifying all documents or agencies.

C.2.1 Problem Definition

Agencies selected for the survey had generally dealt with trail user conflicts and had utilized a variety of creative and successful solutions. When contacted for the survey, several agencies stated that trail user conflicts are a significant issue for their trail management, and that they are interested in other jurisdictions' best practices.

However, several other agencies indicated that trail user conflicts are not an issue in their jurisdiction. The State Parks Monterey Sector, Asilomar Sector, and Big Sur Sectors reported that complaints are so low that they did not complete the survey. Other agencies or State Parks districts completed the survey but stated that they did not feel conflicts between user groups on unpaved trails were an issue in their jurisdiction. These include: State Parks Calaveras Sector, Colorado Desert District, Four Rivers District, San Joaquin District, Turlock Lake SRA/Caswell Memorial SP/Bethany Reservoir, Channel Coast District, Memorial SP/Bethany

Reservoir, Conejo Open Space Trails Conservation Agency (COSCA), Hill Country Conservancy, and San Luis Obispo County.

The USFS Lake Tahoe Basin Management Unit staff highlighted the difference between incidents and complaints as indicators of user conflict, noting that use conflicts are "very subjective and determined by individuals."

Data Availability

The Project Team requested incident and complaint data from each agency sent a survey. This request was reiterated when surveys were returned. The survey also asked respondents to provide their professional judgment about the frequency of complaints, which may include formal written complaints or discussions at events, public meetings, or other feedback. Respondents were also asked about the frequency of incidents (actionable events), including injuries due to collisions, non-injury collisions, and 'close calls negatively affecting user experience.'

Complaint Data

None of the agencies surveyed provided complaint data. However, the majority receive complaints in some form, whether at the trailhead, in public meetings, or via an online complaint form such as State Parks Gold Fields District and the Tualatin Hills Park and Recreation District (THPRD)'s 'Park Watch' website. State Parks Gold Fields District responded that complaints sometimes come in the form of an e-mail or phone call and may be shared with Parks staff to address the problem, although the District does not retain information.

Agency representatives typically estimated that they receive complaints about perceived conflicts on a monthly or weekly basis. By contrast, incidents are estimated to occur yearly or less frequently.

Incident Data

While few of the agencies surveyed provided incident data, the majority of representatives responded that in their professional experience, actual incidents are uncommon. As shown in Table C-2, only eight of the agencies surveyed maintain incident data, and four of those reported no incidents. Santa Clara County Parks and Recreation provided data which indicate that eight to twelve incidents involving multiple uses occurred during 2008-2010 (four of the equestrian-related injuries did not provide information about what spooked the horse).

Capital Regional District (CRD Parks) BC stated that, "we have over 80 kms of Regional Trails in our region with over 2 million users per year. Based on that, the ratio of complaints we receive is very low."

The one serious incident cited in the survey responses was in Santa Barbara (under the Front Country Trails Multi-Jurisdictional Task Force's jurisdiction). In 2006, a mountain biker and an equestrian were passing on a narrow trail without shoulders, and the horse fell off the trail, with ultimately fatal results to the horse. The incident prompted design and outreach responses from the management agency.

Table C-2. Incident and Complaint Data Frequency and Data Availability

Agency	Incident Data[i]	Incident Estimate[ii]	Complaint Data[iii]	Complaint Estimate[iv]
Bureau of Reclamation, Lower Colorado Region	No	Monthly	No	Weekly
Forest Service, Lake Tahoe Basin Management Unit	Yes, 0	N/A	No	Monthly
Calaveras Big Trees State Park	No	<1/year	No	Monthly
Columbia State Historic Park	No	<1/year	No	Monthly
Colorado Desert District, State Parks	Yes, 0	<1/yr	Yes, N/A	0
Four Rivers Sector, State Parks	No	<1/yr	No	<1/yr
Gavilan Sector, State Parks	No	<1/yr	No	2-3/yr
Gold Fields District, State Parks	No	Monthly	No	Weekly
San Joaquin Sector, State Parks	No	<1/yr	No	<1/yr
Santa Cruz District, State Parks	No	<1/yr	No	Annually
Topanga Sector, State Parks	Yes, N/A	Monthly	Yes, N/A	Annually
Turlock Lake State Recreation Area/ Caswell Memorial SP/ Bethany Reservoir	Yes,, N/A	<1/yr	No	<1/yr
North Carolina Division of Parks and Recreation - Lake Norman State Park	No	Yearly	No	Yearly
Oregon Parks and Recreation	No	Monthly	No	Weekly
Capital Regional District Parks (CRD)	No	N/A	No	N/A
Conejo Open Space Trails Conservation Agency (COSTCA)	Yes, 0	0	No	4 times/year
Front Country Trails Multi-Jurisdictional Task Force (Front Country)	No	Few	No	N/A
Hill Country Conservancy	No	N/A	No	N/A
Tualatin Hills Park and Recreation District (THPRD)	No	Yearly	No	Monthly
Vancouver-Clark Parks and Recreation Department (VCPRD)	No	N/A	No	N/A
Jefferson County Open Space(JCOS)	No	Yearly	No	Weekly
Mecklenburg County Park and Recreation	No	Monthly	No	Monthly
Sacramento County Regional Parks, Recreation & Open Space	Yes, N/A	Yearly	Yes, N/A	Monthly
San Luis Obispo County	No	2 per year	No	N/A
Santa Clara County Parks and Recreation	Yes, 8-12/ 2 years	N/A	No	N/A
Wake County Parks, Recreation and Open Space	Yes, N/A	Yearly	No	N/A
Town of Crested Butte	No	N/A	No	N/A
City of Durango	No	Yearly	No	Monthly

Agency	Incident Data[i]	Incident Estimate[ii]	Complaint Data[iii]	Complaint Estimate[iv]
City of Henderson	Yes, N/A	Monthly	Yes, N/A	More than once per week
Town of Pagosa Springs	Yes, 0 in 5 years	Monthly	No	Monthly
City of Palo Alto Open Space & Parks	Yes, 0	N/A	Yes, 0	N/A
Portland Parks and Recreation (PP&R)	No	N/A	No	N/A
San Luis Obispo	No	Once per year	No	Once per year
City of Las Vegas	No	0	No	None
Forest Park Conservancy	No	Weekly	No	Annually
Pacific Crest Trails Association	No	Monthly	No	Weekly

[i] *'Incident data' indicates whether the agency collects specific data related to incidents between users on the trails. Agencies that note that they do collect incident data but have N/A did not provide data.*

[ii] *'Incident estimate' is the agency representative's professional opinion of how frequently incidents occur.*

[iii] *"Complaint data' indicates whether the agency retains a list of complaints received from users.*

[iv] *'Complaint estimate' is the agency representative's professional opinion of how frequently complaints are received.*

Prevalent Concerns

By a large margin, agency representatives most frequently cited concerns about speed differential between users on the trail (62 percent), as shown in Figure C-1. The Lake Tahoe Basin Management Unit specifically noted that "speed differentials of more than about 12 mph causes an increase in use conflicts."

Other frequently-cited issues included sight lines (44 percent), narrow trails (32 percent), congestion (24 percent), illegal trail use (e.g. users traveling on a trail via a prohibited mode; 24 percent), user perceptions (18 percent), and failure to yield (18 percent). Several of the concerns are interrelated; sight lines are related to user speeds, while user perceptions of other users could be related to getting passed quickly, without warning.

Several respondents cited a lack of alternative trails for users as a reason for user conflict. Portland Parks and Recreation (PP&R) noted that, "the lack of accessible single track mountain bike trails in the Portland metro area has caused bikers to ride on many of the pedestrian only trails in Forest Park." Similarly, the Folsom Lake Trails Advisory Group and the Santa Cruz District identified a lack of trails relative to mountain biking demand as a cause of user conflict.

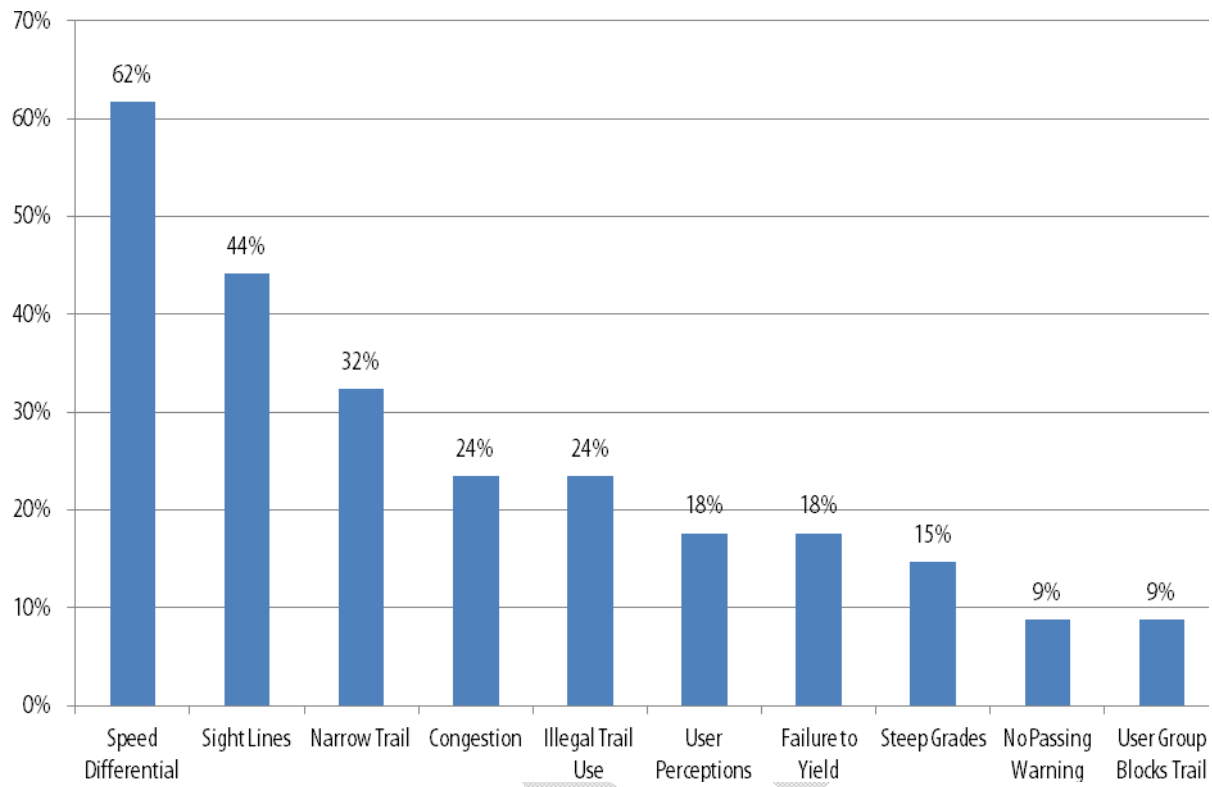

Figure C-1. Factors Contributing to User Conflicts from 34 Agencies Surveyed

Three agencies noted entrenched negative perceptions of other user groups arising from a history of conflict or disagreement; State Parks Gold Fields District, the Front Country Trails Multi-Jurisdictional Task Force (Front Country), and Jefferson County Open Space (JCOS) all cited historic conflicts contributing to an environment where managers had difficulty addressing root causes of conflict perceptions. Oregon Parks and Recreation and the Conejo Open Space Trails Conservation Agency (COSCA) noted that the introduction of a relatively new user group to historic types and levels is a problem. Front Country stated that, because long-time hikers or equestrians do not expect mountain bikers, their unexpected presence exacerbates perceptions of user conflicts.

User Groups in Conflict

Of the 36 surveys returned, the most frequent conflicts cited were between pedestrians/hikers and road bicyclists/mountain bikers (71 percent).The second most frequent concern was related to users with dogs and those without (41 percent). Only 18 percent cited issues between equestrians and mountain bikers. The State Parks Four Rivers Sector noted that Pacheco State Park has heard from equestrians that their horses were spooked during large special events, but "These are just anecdotal and occur infrequently." Similarly, the State Parks Gavilan Sector responded that they have received comments from equestrians about mountain bikers, but complaints are rare and most users share fire trails with sufficient space.

Other conflicting groups mentioned included bicyclists and other bicyclists (9 percent), off-highway vehicles (OHVs; 6 percent), runners and walkers (6 percent), and recreationalists and families (6 percent).

The Bureau of Reclamation, Lower Colorado Region noted that meet-up groups and running clubs sometimes conflict with local residents on the trails. Both CRD Parks and JCOS noted conflicting goals between people using the trails 'as a gym' or for exercise, versus use by families or enjoying nature. State Parks Topanga Sector, Oregon Parks and Recreation, and the Hill Country Conservancy have all received complaints about hikers walking side-by-side and blocking the trail.

The USFS Lake Tahoe Basin Management Unit felt that conflicts arise more from perceptions of other groups than from incidents. The Unit defines a user conflict as being between two individuals, while "the Forest Service manages for use conflicts that reflect a trend of conflict between use groups as a result of uses that are not compatible as a result of trail design, use types, or lack of management."

Where agency representatives commented on which users originated the offending behavior, they generally stated that mountain bikers were responsible for speeding, failure to yield, and not giving a passing warning. Other behaviors that agency representatives felt contributed to user conflicts include all user types wearing headphones (Topanga Sector) and mountain bikers shuttling to the top of a trail system and riding down at high speeds (Front Country).

Locations of Concern

Several agencies noted that concerns of incidents more frequently occur at turns and corners or other locations with poor visibility (Bureau of Reclamation Lower Colorado Region, State Parks Santa Cruz District, State Parks Topanga Sector, COSCA, THPRD, JCOS, Santa Clara Parks and Recreation, and Wake County). State Parks Galvilan Sector noted that user issues occur primarily on single track trails rather than on fire roads, where they feel there is space for all users. State Parks Gold Fields District, Front Country, and Oregon Parks and Recreation reported that issues occur in areas with steep slopes.

Agencies cited concerns both with narrow trails (Front Country, JCOS, and PP&R) and straight-aways where mountain bikers can gain high speeds (State Parks Santa Cruz, THPRD, and JCOS). State Parks Gold Fields and the Santa Cruz Districts cited illegal mountain bike use on hiker/equestrian trails as leading to problems.

C.2.2 Appropriate Trail Design Strategies

The Project Team requested references or copies of design guidelines used by agencies, in particular those agencies that cited design solutions to trail user issues. The State Parks districts and other California agencies primarily refer to the California State Parks' *Trail Handbook* (1991), while the USFS Lake Tahoe Basin Management Unit, COSCA, and the Town of Crested Butte use the Forest Service *Trail Construction and Maintenance Notebook* (FSH 2309.18; 2007).

Several agencies use the International Mountain Bicycling Association (IMBA) manual, *Trail Solutions: IMBA's Guide to Building Sweet Single-Track* (IMBA, 2004) as well as *Managing Mountain Biking: IMBA's Guide to Providing Great Riding* (IMBA, 2007) including State Parks Santa Cruz District, the Hill Country Conservancy, Mecklenburg County, Wake County, Lake Norman State Park, and City of Durango. Design guidelines developed for a specific agency are included in the Literature Review, and pertinent details are included in the appropriate section below.

Design strategies used by multiple agencies include providing separate treads via trail layout (33 percent); maintaining sightlines (19 percent); controlling speeds with pinch points or obstacles(14 percent); providing adequate widths (15 percent); and using curvilinear design (6 percent) shown in Figure C-2. Each of these strategies is discussed in greater detail in the following pages.

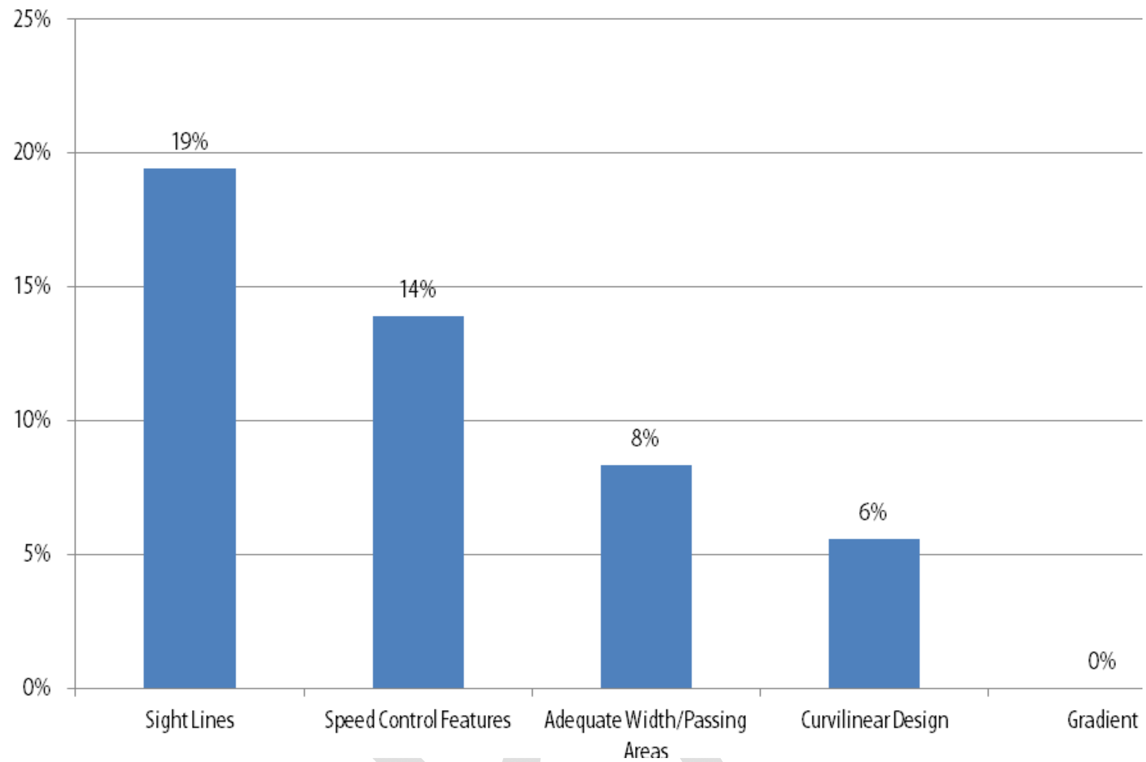

Figure C-2. Design Technique Results from 36 Agencies Surveyed

Sight Lines

Sightlines are a frequently-cited concern about mixing users on trails. Front Country, Santa Clara County Parks, THPRD, PP&R, City of Durango CO and the Town of Crested Butte CO all generally stated that they reduce conflicts by designing and maintain good sight lines (but did not define what that would be). The Town of Pagosa Springs CO noted a policy of thinning overgrowth, especially near curves.

The Santa Clara County Parks Department's design guidance contains specific instructions related to designing and maintaining good sight lines; the clearing width and trail curvature should assure a 100-foot average sight distance where possible. If sight distances are less than 100-feet, the guidance recommends considering posting safety signs and reducing speed limits (Santa Clara County Interjurisdictional Trails Committee, 1999). In addition, the County recommends designing grade rises on approaches to trail junctions and in locations with poor sight lines.

The PP&R guidance for sight distance on a hiking/mountain biking/equestrian trail is 40 to 100 feet, "depending on speed/flow" (2009). Front Country has used community organizations and volunteer assistance to maintain good sightlines on trails by cutting back vegetation that was encroaching on the trail.

Speed Control Measures

Seven of the surveyed agencies intentionally slow mountain bikers' speed through trail design using pinch points or trail anchors. Wake County Parks, Recreation and Open Space designs 'speed chokes' in the trails. Similarly, JCOS uses what they describe as chicane-style traffic calming to reduce mountain bikers' speeds. The Lake Tahoe Basin Management Unit noted the use of 'technical trail features' (TTF's) to slow users and to "meet their needs on certain trails." State Parks Santa Cruz District has used pinch points to decrease speeds, but they reported that user groups sometimes remove these features.

None of the agencies that discussed speed reduction strategies had specific design guidelines or guidelines for use. Several of the agencies (both those that mentioned using design to reduce speeds and those that did not) cited the IMBA manuals, which detail the use of rolling contour trails, obstacles, choke points, turns, and other strategies for reducing speeds.

Adequate Width and Passing Area

Five of the agencies noted standards for width that have helped reduce user conflicts. THPRD PP&R, and Mecklenburg County all responded generally that they seek to provide sufficient width on trails. Several agencies' design guidelines specify different widths depending on the expected amount or type of use, includingCRD, THPRD, and Santa Clara County Parks. Most of these systems designate Regional, Community, and Local paved trails, without specifying divisions or optimal widths for different types of soft-surface trails. Santa Clara County Parks' *Uniform Interjurisdictional Trail Design, Use, and Management Guidelines* recommends providing sufficient width based on level of trail, specifying that 6 feet is the minimum width to allow two wheelchairs to pass each other (Santa Clara County Interjurisdictional Trails Committee, 1999).

PP&R's design guidelines designate a 4-foot minimum width on hiking/mountain biking trails (equestrians are allowed), noting that passing areas should be provided (2009). Oregon Parks and Recreation also noted that designing trails for shared-use from their development is more successful than retrofitting trails to accommodate multiple users.

Santa Clara County Parks also constructs single-track trails with a 5- to 6-foot bench that they allow to revegetate to 3 to 4 feet of width, providing a safe place for users to step off the trail to allow others to pass.

Many guidelines recommend providing wider turn-out/passing areas at regular intervals where trails are narrower than 8 feet. Wake County NC recommends building triangular intersections at key locations to regulate the flow of users and to minimize collisions. PP&R requires passing areas on hiking/mountain biking/equestrian trails 4 feet or narrower (2009). None of these guidelines provide information about how large the passing area should be, or how frequently located.

Sinuous Design

Strategies included curving, sinuous and undulating trails; also designing a trail so users arrive at an intersection or conflict area traveling uphill. Santa Clara County Parks' *Uniform Interjurisdictional Trail Design,* *Use, and Management Guidelines* recommend undulating trails to reduce speeds, control water flow, and enhance user experience (Santa Clara County Interjurisdictional Trails Committee, 1999).

Santa Clara County Parks reported design practices not contained in their design guidelines, but found to be very effective by trail managers, including constructing a trail with a grade change so that users approach a ridge nose (where sightlines are poor) or a trail intersection at an uphill in either direction. In general, County Parks constructs undulations in the trail to enhance user experience, control water flow, and moderate speeds. County Parks has found that trails with undulations and sinuosity slow trail users.

Gradient

It is relevant to note that, while 15 percent of agencies cited steep trails or other grade-related issues as causing user conflicts, none of the surveys provided guidance for designing grades to address conflict.

C.2.3 Management Strategies

Most of the agencies surveyed (78 percent) reported that they use signs or other user information to remind users to share the path. (While it is expected that all agencies post signs, more than three-quarters noted it as a conflict management strategy). However, agency representatives varied on whether they felt signs had any impact on user behavior. Other key management strategies include enforcement (31 percent), through rules and regulations such as posting speed limits (19 percent), or through public notification of planning or management decisions (19 percent). Only 3 percent of agencies noted data collection as an element of their conflict reduction or management strategy.

Policies to manage trails include exclusionary policies, which may prohibit motorized or specific user types, as well as policies that define trail behavior and etiquette such as a speed limit or yielding to other users. These policies and other etiquette guidelines are often posted on signs at trailheads and enforced by park rangers or another authority. Some agencies have the ability to issue citations or exclude specific users who break the rules.

In addition, COSCA mentioned policies related to other power driven motorized devices (OPDMDs) and CRD Parks has a policy about use of motorized bicycles on paved trails.

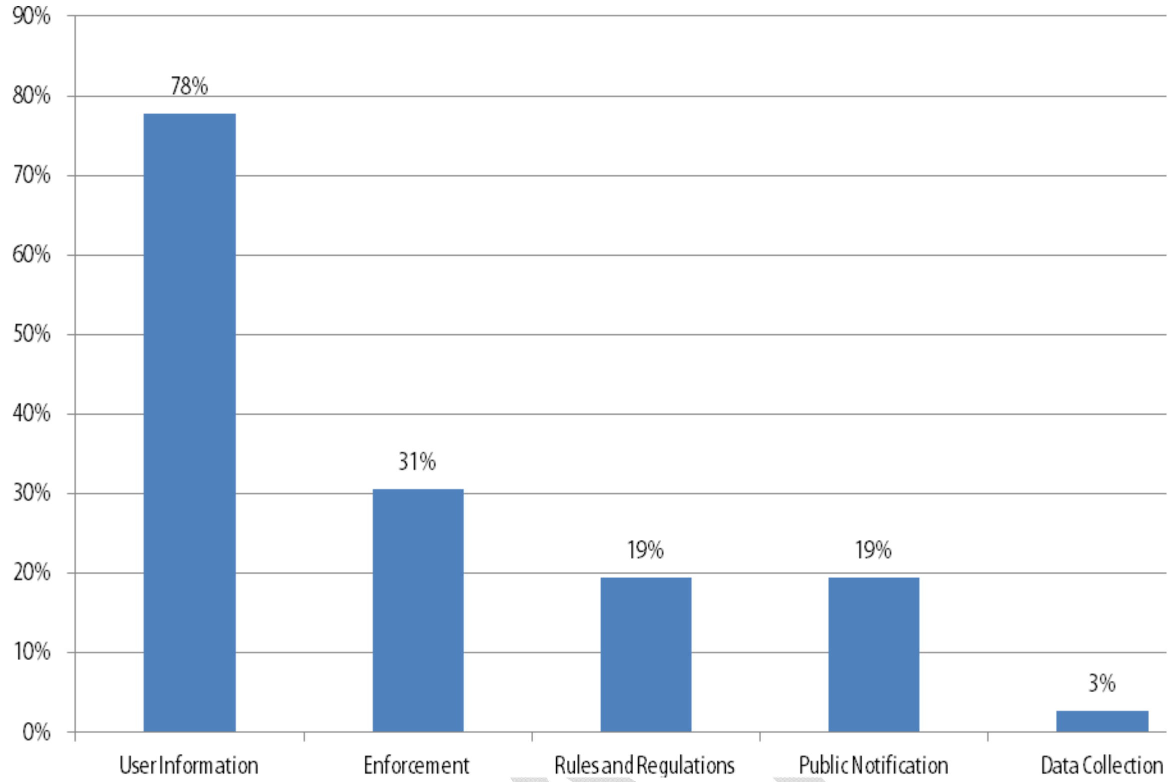

Figure C-3. Management Technique Results from 36 Agencies Surveyed

Alternate Use Days and Times

JCOS has designated alternate use days (i.e., mountain bikers on one day and hikers on another) as well as directional travel (mountain bikers can only ride in one direction on certain days). JCOS staff reports that the alternate use was a successful management response, as were the separate trails. User groups were resistant at first but were eventually satisfied with the management strategy.

In Santa Barbara, the Forest Service initially recommended alternate use, but the process did not include public involvement or multi-agency coordination, resulting in significant public resistance to the strategy. The Town of Pagosa Springs also reports that efforts to institute alternative use days were unsuccessful.

Separate and Specialized Trails

It is a common strategy to separate users who travel at different speeds with parallel treads in the same trail corridor. Similarly, some agencies note that they provide specialized trails for mountain bikers, where they can ride quickly and not expect to encounter other users. In some cases, dedicated mountain bike trails can be provided to encourage users to travel more slowly on shared trails. COSCA and the City of Henderson both mentioned this strategy.

User Information

Most jurisdictions reported posting trail courtesy and rules signage. State Parks Gavilan Sector noted that the majority of users are well-informed by posted trail etiquette signs, while the Town of Crested Butte CO reported that signs are primarily useful for out-of-town visitors.

However, several agencies felt that signs did not address problems with users. State Parks Gold Fields District, THPRD, Mecklenburg County Park and Recreation, and PP&R felt that signs on their own were insufficient. The Hill County Conservancy feels that only users who are already law-abiding pay attention to signs. State Parks Santa Cruz District noted that signs tend to be vandalized by excluded user groups. The City of Palo Alto also provides user information about trail conditions via social media (Facebook and Twitter).

Enforcement

The presence of rangers or other authority figures on the trail can deter undesired activities and encourage users to employ trail etiquette. Where speed limits are posted, rangers can enforce speeds or issue citations or warnings to rule breakers. In Mecklenburg County and the City of Durango, off-duty police work sections of the trails. In other locations, rangers patrol the trail system (THPRD, City of Durango, and PP&R). In Portland, a ranger position was created to enforce proper passing and speeds on trails.

At State Parks Gold Fields District, equestrian groups have felt that spot enforcement was successful in reducing behavior that leads to conflicts, although the agency noted that actual success of the program is uncertain.

Rules and Regulations

While speed limits tend to be posted on paved shared-use trails, several agencies reported using speed limits on unpaved facilities. Santa Clara County Parks, State Parks Gold Fields District, Jefferson County, and Sacramento County all have posted 15 mph speed limits. Jefferson Countyis considering 'zoning,' whereby users are expected to dismount or reduce speeds in certain areas, although zones have not been implemented.

Several of the agencies have the ability to cite, give warnings, or exclude users who break rules. Oregon Parks and Recreation and State Parks Gold Fields District have citation authority but rarely use it; in the Gold Fields District, a peace officer has to catch the violation as it occurs. THPRD and the Hill County Conservancy can exclude users who violate trail rules. While the Bureau of Reclamation Lower Colorado Region does not directly manage trails, the agency encourages their management partners to issue citations to offending users.

Collecting and Tracking Data

Few agencies take the time to record and track data regarding trail use conflict. JCOS is monitoring incidents and complaints to gauge the efficacy of their strategies. While the report is not complete, it will provide an important resource.

C.2.4 Outreach and Coordination Strategies

Several agencies responded that working with trails groups, holding public meetings and educating the public had the greatest effect on reducing conflicts between users. The most common outreach category was education (44 percent), followed by volunteer programs (31 percent), user group meetings (31 percent), user group notification (19 percent) and holding events (17 percent), as shown in Figure C-4.

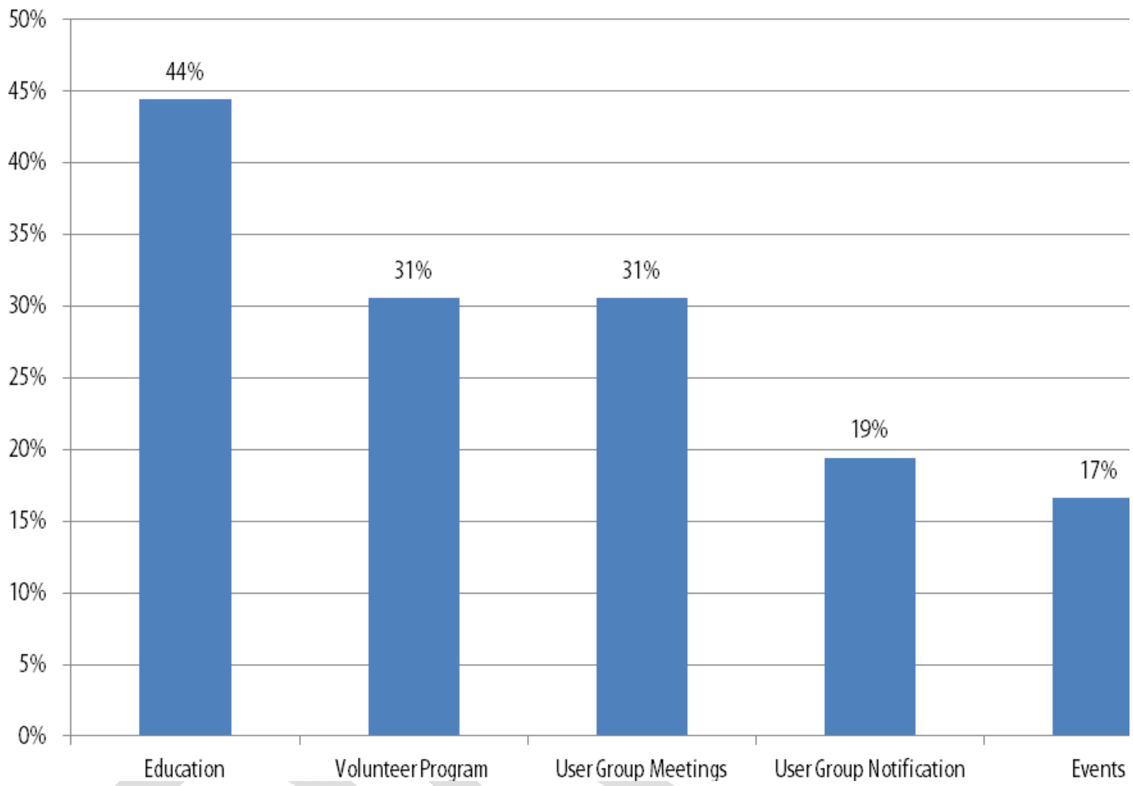

Figure C-4. Outreach Technique Results from 36 Agencies Surveyed

Education

Many of the agencies who have ranger patrols or who work with volunteers reach out to users through those avenues. Some agencies specifically cited speaking with trail users about sharing the trail as a successful strategy (Lake Norman State Park, Turlock Lake State Recreation Area, JCOS, Front Country). Turlock Lake State Recreation Area staff noted that education that informs users the spirit of trail development and the agency's goal and mission is most effective. In Santa Barbara, staff from the three jurisdictions that are part of Front Country presented best practices of trail sharing to the public in order to increase compliance.

COSCA teaches trail etiquette to local schoolchildren through skits performed at the annual Trails Education Days. They previously gave out key chains with the yellow etiquette symbol at public events but discontinued that practice due to budget cuts.

Volunteer Programs

Several agencies work with volunteers to maintain or patrol trails or to encourage and exhibit proper trail etiquette. State Parks Gold Fields District, JCOS, THPRD, and CRD Parks all have active volunteer patrols.

The City of Henderson has a volunteer Trail Watch program, in which volunteers monitor trail use and model appropriate trail use by providing information and assistance to all trail users. The volunteers document incidents that require the City's attention. The City reports that the Trail Watch program is very successful, as it provides a sense of ownership.

User Group Meetings

Many of the agencies reported working with established user groups to be a successful or necessary strategy. State Parks Gold Fields District designates a staff member to attend user group meetings and to work with particular groups on trail work days. Mecklenburg County and the City of Durango recommend maintaining regular communication with different user groups and bringing issues to them as necessary.

In some cases, agencies reached out to individual trail users independent of user organizations. This type of collaboration can be formalized through a trails committee (State Parks Gold Fields District, COSCA, VCPRD) or via open houses. Several agencies hold stakeholder meetings to discuss solutions to user conflicts (Bureau of Reclamation Lower Colorado Region, City of Henderson), while others hold multi-user trail meetings when developing plans (Oregon State Parks and Recreation and Front Country).

Trail Events

Agencies and user groups hold a variety of events on trails, including events with specific 'Share the Trail' messages and more general trail clean-up or maintenance days. COSCA holds "Trails Education Days" annually for 5^{th}graders. State Parks Gold Fields District has assigned specific staff to work with various user groups on trail work days, which sometimes include both mountain bikers and equestrians.

The Mountain Bikers of Santa Cruz hold a carrot ride at Wilder Ranch State Park, wherein mountain bikers hand carrots out to horses to make a positive connection with the horse, to reduce horses' likelihood of being spooked when mountain bikers approach. In partnership with the City of San Luis Obispo, the local mountain bike user group holds bell give-aways, which have had a positive impact on mountain bikers' use of bells when passing other trail users.

Several agencies collaborate with trail groups to plan, construct, and manage trail projects (VCRD, Town of Crested Butte, Mecklenburg County, City of Durango, and Oregon Parks and Recreation).

Table 10 provides a summary of the design solutions and management and outreach strategies indicated by the 36 survey respondents.

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Table C-3. Matrix of Agency Survey Responses to Trail User Conflict Solutions

		Design Solutions						Outreach					Management							
ID	Agency	Trail Layout/Availability	Sight Lines	Speed Control Features	Adequate Width/Passing Areas	Curvilinear Design	Gradient	Education	Volunteer Program	User Group Meetings	User Group Notification	Events	User Information	Enforcement	Ranger Patrol	Speed Limit/Citations	Public Notification	Designated Use-Intensive	Data Collection	Alternate Use Days
1	Bureau of Reclamation, Lower Colorado Region			x				x	x	x			x	x		x	x			
2	U.S. Forest Service, Lake Tahoe Basin Management Unit			x																
3	Calaveras Sector, State Parks	x						x							x					
4	Columbia State Historic Park												x	x	x					
5	Colorado Desert District, State Parks																			
6	Four Rivers Sector, State Parks																			
7	Gavilan Sector, State Parks												x							
8	Gold Fields District, State Parks	x							x	x	x	x	x	x		x				
9	San Joaquin Sector, State Parks												x							
10	Santa Cruz District, State Parks			x								x	x							
11	Topanga Sector, State Parks							x			x						x			
12	Turlock Lake SRA/Caswell Memorial SP/Bethany Reservoir							x					x	x						
13	North Carolina Division of Parks and Recreation - Lake Norman State Park							x					x							
14	Oregon Parks and Recreation	x								x			x							
15	Capital Regional District Parks							x	x				x				x			
16	Conejo Open Space Trails Conservation Agency							x	x	x		x	x					x		
17	Front Country Trails Multi-Jurisdictional Task Force		x					x	x	x		x	x							
19	Hill Country Conservancy	x													x					
20	Tualatin Hills Park and Recreation District		x										x	x	x					
21	Vancouver-Clark Parks and Recreation	x								x	x		x				x			
22	Jefferson County Open Space	x	x	x				x	x	x	x	x	x			x	x			x
23	Mecklenburg County Park and Recreation	x			x								x	x	x					
24	Sacramento County Regional Parks, Recreation and Open Space	x											x			x				
25	San Luis Obispo County							x					x						x	
26	Santa Clara County Parks and Recreation		x		x	x		x			x			x	x	x				

ID	Agency	Design Solutions						Outreach					Management							
		Trail Layout/Availability	Sight Lines	Speed Control Features	Adequate Width/Passing Areas	Curvilinear Design	Gradient	Education	Volunteer Program	User Group Meetings	User Group Notification	Events	User Information	Enforcement	Ranger Patrol	Speed Limit/Citations	Public Notification	Designated Use-Intensive	Data Collection	Alternate Use Days
27	Wake County Parks, Recreation and Open Space			x									x							
28	Town of Crested Butte	x							x	x			x							
29	City of Durango		x					x	x	x	x		x	x	x					
30	City of Henderson	x						x	x	x		x	x	x			x	x		
31	Town of Pagosa Springs	x	x										x							
29	City of Palo Alto Open Space & Parks		x		x	x				x	x		x			x	x			
32	Portland Parks and Recreation	x						x					x	x	x	x				
33	San Luis Obispo								x											
34	City of Las Vegas												x							
35	Forest Park Conservancy							x	x				x							
36	Pacific Crest Trails Association							x					x	x						

C.3 Review of Key Surveys

Of the 36 surveys returned, 11 stood out as examples that provide specific guidance for managing trail incidents and user conflicts. These agencies manage a significant number of unpaved shared-use trails and provided substantial information, including design guidelines, management policies, and other documentation to expand on the strategies used. Agencies that responded that they have few issues with conflicts between users, or who focused their responses on issues on paved paths or with dogs or vehicles, are not included in the 'key' surveys.

C.3.1 U.S. Forest Service, Lake Tahoe Basin Management Unit

The Lake Tahoe Basin Management Unit oversees all Forest Service roads and trails around Lake Tahoe. They manage 160,000 acres of land and 415 miles of trails, both paved and unpaved. Most user types are accommodated, including off-highway vehicles (OHVs), motorcycles, hikers, equestrians, dog walkers (on leash), and bicyclists (road and mountain bike).

Nature of the Problem

The Management Unit records incidents, but no incident has been recorded where an injury was involved. Reported incidents occur less than once per year, while congestion occurs in July and August on about 10 different trails.

The Management Unit draws the distinction of 'user conflicts' between two or a group of users, and 'use conflicts,' which are a trend of conflict between use groups "as a result of uses that are not compatible as a result of trail design, use types, or lack of management."

Most complaints received by the Management Unit are specific to local areas; in one location users complain about the presence of dog feces, while at others users may complain about equestrian or mountain bike use. Several complaints about incidents involving mountain bikers had been reported on the Lake Valley Trail, which the Management Unit rerouted and reconstructed as a response.

Solutions

Staff feel that trail design or layout can contribute to or resolve user incident issues, particularly short sight lines, confined areas, and over-steep grades. Other factors include differing user goals and knowledge, speed differential, and other site-specific factors. Perceptions of user conflict arise primarily from attitudes about sharing the trail and repeat offenders who are looking for a conflict. The Management Unit also views signage informing users of trail rules as an important avenue for educating users about trail sharing etiquette.

The Management Unit mitigates trail user conflicts by focusing on embracing shared-use management. Staff feel that "over use of exclusion is harmful for all trail users and we avoid it unless there are safety issues."

The primary design document is the Forest Services' *Trail Construction and Maintenance Notebook* (FSH 2309.18). They have also used technical trail features (TTFs) to reduce mountain bikers' speeds and to design interesting trails, although they recognize that the approach is not appropriate on all trails.

Management policies refer to the Multiple-Use Sustained-Yield Act of 1960.[1] In addition, the Management Unit attempts to identify perceived conflicts versus actual conflicts, minimizing exclusion of groups unnecessarily.

Bureau of U.S. Forest Service, Lake Tahoe Basin Management Unit Lessons Learned

Design Best Practices

- Use the Forest Services' *Trail Construction and Maintenance Notebook* (FSH 2309.18).
- Maintain good sightlines.
- Reduce mountain bikers' speeds where appropriate with use of technical trail features (TTFs).

Management Best Practices

- Post signs educating users about etiquette and yielding expectations.

C.3.2 California State Parks, Gold Fields District

The Gold Fields District is located in Folsom and includes the Folsom Lake State Recreation Area (SRA) and Auburn SRA. Folsom Lake SRA is 20,000 acres with about 100 miles of trails, while Auburn SRA is 26,000 acres with 118 miles of trails. The majority of trails in the District are designated hiker/equestrian, with few trails that also allow mountain biking. The District is working on revising its posted order to better document the current use designations.

Nature of the Problem

Gold Fields District staff report that most of the conflicts and incidents on unpaved trails are between equestrians and mountain bikers or pedestrians and mountain bikers. Folsom Lake SRA occasionally has problems between pedestrians and road bicyclists on the paved trails. Staff report that most incidents occur on trails where mountain bikers are prohibited and are riding illegally. Areas with high use, intersections with shared-use trails, and areas with blind corners or poor sight lines are also problem areas.

State Park peace officers write an incident report when it results in an injury or if there is criminal activity. Complaints are not systematically recorded or retained by State Parks, although they may be shared with other Parks staff to address a particular problem. In addition, equestrian user groups at Folsom Lake SRA have developed a "Park Watch" website where users can record incidents and complaints. Staff members estimate that they receive informal complaints approximately weekly, and reported incidents (to which staff responds) monthly. Injuries due to collisions occur approximately quarterly.

The Folsom Lake Trails Advisory Group identified the lack of trails relative to demand, particularly for mountain bikers, as a factor that led to user conflict. Poor etiquette by all trail users also leads to situations where mountain bikers' speeds can lead to an incident. Staff writes, "The long history of user conflicts at Folsom Lake SRA has led to entrenched negative perceptions by both equestrians and mountain bikes or the

[1] http://www.fs.fed.us/emc/nfma/includes/musya60.pdf

other user group. Neither of these groups is homogenous in their use of trail etiquette, but the negative actions and rhetoric of some users have affected the wider perceptions of many users on either side of this conflict.

Solutions

The District uses State Parks' *Trails Handbook* (1991), which provides guidelines for the development, construction and maintenance of trails. However, most trails predate the Handbook, and the staff feel that they are poorly aligned and inadequately maintained.

The District has posted speed limit signs, caution signs, and trail use etiquette signs on some trails, but is in the process of updating the signs. Staff considers signing not to be generally successful in preventing illegal use of trails or compliance with speed limits. Spot enforcement has been seen positively by equestrian groups, but the actual success is uncertain. The District can issue violation notices for illegal trail use if violators are caught in the act by a peace officer. Folsom Lake SRA has a volunteer Mounted Assistance Patrol.

The District set up the Folsom Lake Trails Advisory Group (FTAG) in 2000 to address user conflicts between equestrians and mountain bikes at Folsom Lake SRA. Facilitated by State Parks staff, the group included representatives from equestrian, mountain bike, runner, hiker and youth user groups. FTAG worked on changing a limited use trail to shared-use. However, the planning process was held up and members left the process dissatisfied.

The District has assigned staff to work with user groups, including the volunteer patrols, equestrian user groups and mountain bike user groups. Staff attends the meetings of these groups and work with user groups on trail work days, which sometimes include mountain bikers and equestrians.

District staff believes that the long term solutions to issues associated with user incidents in Folsom Lake SRA include developing more trail opportunities for all users, particularly mountain bikers and improving design through repairs, re-routes, and improved maintenance.

California State Parks, Gold Fields District Lessons Learned

Design Best Practices

- Use the State Parks *Trails Handbook* (1991) to retrofit trails for multiple uses.

Management Best Practices

- Provide sufficient trail opportunities for all user types.
- Enforce appropriate use of trails.

Outreach Best Practices

- Involve stakeholders in an advisory committee.

C.3.3 Front Country Trails Multi-Jurisdictional Task Force, California

As a partnership of the City and County of Santa Barbara and the Los Padres National Forest, the Front Country Trails Multi-Jurisdictional Task Force (Front Country) was formed to create and implement trail management objectives and programs. Consisting of staff representatives of all three governmental agencies, the group manages 30 miles of trail most of which are narrow natural surface trails that accommodate hiking, horse riding, bicycling, and trail running.

Nature of the Problem

Although not recorded, trail use conflicts and incidents in the Front Country trail system have occurred for 30 years. User complaints are received at Front Country meetings and public education events.

The speed of downhill bicyclists, near misses between bikers and other users, and equestrians who are nervous about encountering bikers on the trails contribute to incidents and conflicts. Concerns are also related to the trails being too narrow to allow different user groups to safely pass in different directions. In 2006 a mountain biker and an equestrian were passing each other on a trail and the horse fell over the side and died. Equestrians have reported avoiding the shared-use trails because they do not feel safe sharing the trail with mountain bikers. Individual equestrians have lobbied for prohibiting bikes on the trails so that they will be safe for equestrian use.

In particular, the Sierra Club is active in the region and is vocal about issues with bikers. Based on public comment, most concerns seem to occur where line of sight is impaired and where a steep grade leads to higher bike speeds. At public education events, complaints are primarily associated with issues between hikers, walking dogs, and other hikers.

Perceptions based on historical expectations likely contribute to user conflicts, as the trails predate mountain biking, although the last 20 to 30 years have set a precedent for shared-use. Physical characteristics that contribute to incidents include: average grades of 12 percent with some areas as steep as 26 percent and steep drop-offs, which create high speeds for downhill bikes, and areas that have little space for users to pass each other safely. Brush growth in the summer inhibits lines of sight, leading to users being surprised by approaching bikers. In addition, since the majority of the road accesses are at the top of the trail, the system has become popular with downhill mountain bikers who shuttle to the top and ride down at high speeds, exacerbating concerns and conflicts among other users.

Solutions

Initially, the Task Force focused education on standardized trail etiquette and information signs at trailheads. Signs help clarify expected behavior and set the expectation of shared-use, which has particularly reached users from outside the local community. A Forest Service community forum worked for several years to resolve user conflict issues and established a plan for a pilot project of odd/even day alternating uses on one trail. However, when the public became aware, there was a backlash from individuals not involved in the process, which lead to the plan being abandoned. The current Task Force structure assures a completely open process that is accessible at city and county levels as well involving Forest Service personnel. The task force also tried to empower a single community group made up of members from all user groups to serve as an umbrella group which would take on trail stewardship and bring user groups together. However, staff report that the political climate in the community has made these efforts fruitless.

Enhanced volunteer engagement in trail maintenance has allowed for better brush clearing and repair of eroded areas of trail, which has led to better lines of sight and fewer narrow, loose areas of trail. Standardized trail rehabilitation guidelines have allowed community organizations to assist with rehabilitating specific trails for safer equestrian, and therefore shared-use, access. Better trail maintenance and rehabilitation is expected to lower the number of actual incidents on the trail, though staff estimate that few actual incidents occurred before or after the enhanced trail maintenance (Front Country does not have a formal reporting system).

Creation of a multi-agency task force with regular public meetings has been vital to provide the public a legitimate place to express their concerns about other trail users. This partnership has decreased overall hostility and served as a catalyst for problem solving. Staff from the City and County of Santa Barbara and the Los Padres National Forest have gathered and presented best practices in trail management and user conflict. The task force serves as the major educational outreach to help set user expectations for Front Country's shared-use trails.

The Santa Barbara Mountain Bike Trail Volunteers, an IMBA group, has led the mountain biking community in educating users about proper etiquette and in encouraging use of bike bells. Other users have noticed the local bike community's courtesy and helped to diminish conflict and shift the conversation from 'bikes are bad; how do we eliminate them?' to 'how do we change the behavior of certain bicyclists?' However, entrenched conflict among long-time users remains.

The Task Force continues struggling with issues of entrenched perceptions of conflict, seeking to build trust between groups and to manage user expectation. Open and respectful communication at all levels is considered critical.

Front Country Trails Multi-Jurisdictional Task Force Lessons Learned

Design Best Practices

- Organize volunteer trail days to provide a higher level of maintenance than otherwise possible.
- Use standardized trail rehabilitation guidelines.

Management Best Practices

- Use standardized signs.
- Present information about proper etiquette.

Outreach Best Practices

- Engage volunteers in trail maintenance activities.
- Create a formal Task Force to manage the multi-jurisdictional area.
- Hold regular public meetings to discuss issues.
- Maintain open communications and collaborate on management solutions.

C.3.4 Oregon Parks and Recreation Department

Oregon Parks and Recreation Department (OPRD) manages nearly 102,500 acres of natural, recreational, and historic resources throughout the State of Oregon. OPRD's parks, trails, recreation, and natural areas consistently rank among the top ten most-visited parks systems in the nation. Approximately 960 miles of recreational trails and 220 non-vehicle bridges make up the OPRD trails system. Most trails are natural surface or compacted gravel with the exception of the bridges and boardwalks and accommodate hikers, cyclists, and equestrians.

Nature of the Problem

Most complaints have to do with other trail users not sharing the trail or following trail etiquette protocols to allow passing (pedestrians) or maintaining safe speed (bikers). OPRD also receives complaints about horse manure on trails. Many complaints are related to specific uses that cause erosion and widened wet areas, which make the trail unusable for parts of the year.

All user groups have complaints about other groups. Staff report that mountain bikers tend to complain less than other groups, but OPRD maintains fewer miles of trails that allow mountain bikes than other miles of trail open to equestrians and hikers. Most of the complaints come during summer months and peak weekend times when more people are using the trails. User conflicts are attributed to increasing levels of use by a user group that was not historically as frequent and perceptions of other trail users.

Solutions

OPRD recommends providing separate treads for different users where space allows. If health, incident occurrences, or natural resource issues prove unworkable, OPRD will separate user groups to different trails. Once trails are closed to a group of trail users, OPRD has the option of issuing citations to violators, but that action is rarely taken.

OPRD engages in shared-user trail meetings to develop trail plans to meet all users' needs. The biggest success has come when users work together to develop a solution. This reduces the tendency for users to have a negative perception of an entire group based on one bad experience and allows relationships to be built.

From experience, OPRD has learned that poor trail design has the biggest impact on user conflict and incident occurrence. However, trails that are designed sustainably and with multiple user groups in mind have few conflicts. Several of the areas that receive the most complaints are areas where the trails are old logging roads that are now managed as part of the trail system and open to all trail users.

Oregon Parks and Recreation Lessons Learned

Design Best Practices

- Design for shared-use from the beginning.
- Provide separate designated-use trails when space allows or other alternatives are not effective.

Management Best Practices

- Allowed-use and etiquette signs posted.

Outreach Best Practices

- Engage multiple user groups to develop trail solutions.

C.3.5 Jefferson County Open Space, Colorado

Jefferson County Open Space (JCOS) has jurisdiction over almost 39,000 acres of land, with over 200 miles of trails. Trail surfaces vary and all types of users are allowed on the system, with restrictions for specific trails.

Nature of the Problem

JCOS staff estimate that they receive a complaint approximately each week. Reported incidents occur approximately on an annual basis. Staff acknowledge that not all collisions (injury or non-injury) may be reported.

The majority of complaints JCOS receives are related to off-leash dogs. In addition, users complain about the speed differential between hikers and bikers, particularly mountain bikers on a downhill trail segments. Conflicts more frequently occur during periods of heavy use, in particular weekday late afternoons and weekends. The majority of conflicts involve mountain bikers and hikers, as well as hikers with off-leash dogs and those without dogs. Complaints with regards of off-leash dogs occur throughout the system.

Design issues identified include narrow unpaved trails in the foothills that have bends with limited visibility due to heavy vegetation or trees. Narrow trails may have poor lines of sight that cause users to not see one another, and lack of space for passing contributes to perceptions of conflicts. On the other hand, staff note that wide trails allow mountain bikers to travel at fast speeds, increasing concern among users.

Complaints also arise due to the variety of user types and difference in capabilities and user expectations. Users on JCOS' trails vary from expert riders who are exercising, to families with children on a leisurely stroll or riding to enjoy nature. In addition, the agency reports that some individuals have existing negative perceptions of particular user groups, which contributes to complaints about those user groups on the trail.

Solutions

JCOS staff have been dealing with conflict issues for a significant time on established parks and has had the opportunity to plan new parks and trails anticipating shared use. Design elements used to reduce conflicts include: establishing a chicane-style traffic calming structure of rock and fencing, creating segregated access trails at trailheads, and managing vegetation to maintain sight lines. In addition, JCOS posts etiquette signs at trailheads and other strategic locations throughout the trail system.

Educational efforts have included the Bike Right and Share the Trail programs and using volunteer patrollers to monitor users on the trail. Staff had tried mitigating conflict with educational special events and by increasing patrols. However, they did not find that these outreach efforts resulted in changing the behavior of some of the faster users. As a response, staff began engaging user groups and developing management options in collaboration with users.

JCOS has provided some separate trails for hiking uses only, as well as a park used exclusively for hiking. Additional management responses have included alternate use days (i.e. bikers on one day and hikers on another), directional travel (mountain bikers one direction on certain days), and speed limits at one urban park and on concrete bikeways. JCOS staff reports that the alternate use was a successful management response, as were the separate trails. JCOS also developed a new regulation regarding the manner in which users are required to pass one another on trails. While resistance from user groups was evident at first, satisfaction with the overall management was high with both management actions.

JCOS documented the increase in incident reports at an established park and responded by engaging park users in developing alternatives. Through this collaboration, the County decided to implement an alternating day directional restriction to mountain bikers. Visitors now can select trails in anticipation of where faster users might be present. No user types are prohibited from accessing the park at any time. JCOS is in the second year of monitoring compliance and user satisfaction with treatments to decrease the number of incidents among visitors at this park. The program will continue specific outreach and enforcement activities to sustain initial improvements. The initial responses from user groups have been favorable.

During the planning and public input phase of a new park, JCOS initiated alternating weekend day use by hikers and mountain bikers. The park website provides alternatives for hikers or mountain bikers who arrive at the park on the wrong day. Equestrians are allowed on the trails at any time.

JCOS also constructed an additional mile at of mountain bike trail to provide a complete experience to all users despite any directional restriction. JCOS is also considering "zoning", whereby bicyclists would be required to dismount or reduce speeds.

Jefferson County Open Space, Colorado

Design Best Practices

- Avoid wide trails where users can build speeds.
- Address sight lines and provide passing space on narrow trails where there is potential user conflict while passing.
- Establish chicane-style traffic calming structures of rock and fencing.
- Create separate trails for hikers and mountain bikers at trailheads.
- Manage vegetation to maintain sight distances.

Management Best Practices

- Post etiquette signs at trailheads and other strategic locations throughout the trail system.
- Alternate day or weekend use without barring any user types.

Outreach Best Practices

- Engage user groups in development and management of trails.

C.3.6 Santa Clara County Parks and Recreation Department, California

The Santa Clara County Parks and Recreation Department manages 45,000 acres of parks, including 300 miles of paved and unpaved trails. Pedestrians/hikers, equestrians, bicyclists, and dogs (on leash) are allowed on the trails. Walking/running is the most frequent recreation activity (51 percent), followed by hiking (20 percent) and bicycling (14 percent). Only 1 percent ride horses.

The Department's 2003 *Strategic Plan* reconceptualizes the well-established trail system to accommodate the growing numbers of users. The Plan visualizes trails "whose inner rings generally serve more intensive group activities, while outer rings provide for more dispersed recreation opportunities and solitary recreation experiences." The Plan also considers a trail to be of countywide significance if it accommodates the needs of multiple user types from throughout the County and established design standards for trails of countywide significance.

Nature of the Problem

From 2008 to 2010, Santa Clara County Parks recorded 19 injuries on the trail system. Of these, 11 occurred on paved paths. Seven injuries were unrelated to user conflicts (spooked horses, users not paying attention, etc.). Four of the equestrian-related injuries do not provide information about what spooked the horse. Two equestrians were injured by horses spooked while passing other users. Five incidents occurred between two bicyclists, and one incident each involved a bicyclist interacting with a roller blader, jogger, scooter, and a pedestrian, respectively.

County Parks has received several complaints about trail user conflicts. Complaints are generally submitted via comment cards, and do not always contain specificity as to the location or circumstances of the incident. Santa Clara County Parks have seasonal use, and the majority of complaints are received in the spring and summer, particularly on weekends.

The majority of the complaints have been conflicts between equestrians and mountain bikers, originating from the equestrian community. Conflicts between mountain bicyclists and hikers also occur, but less frequently. The majority of the complaints are related to mountain bikers traveling too quickly and not warning other users that they are passing. Design issues identified by the park manager include trail design and grade contributing to high mountain bike speeds and poor visibility.

Solutions

The Santa Clara County Interjurisdictional Trails Committee developed *Uniform Interjurisdictional Trail Design, Use, and Management Guidelines* (1999) to coordinate efforts between the County, the 15 cities, and the other special districts and agencies within the County. The document defines trails in terms of the users' experience, using the following distinctions:

- Level 1. Low Volume/ Remote Experience
- Level 2. Moderate Volume / Rural Area or Natural Experience
- Level 3. High Volume/ Incorporated Urban Experience

The County's design guidelines utilize these levels, designing recommended tread width and surface, shoulder width, striping, signing, and management approaches.

Design guidance related to accommodating multiple user types includes standards for width, accessibility, sight lines, design speed, centerline striping, signage, and traffic calming. One guideline states, "Trail uses should be consolidated where safe within the same trailway, depending on the steepness, available right-of-way, user frequencies, and other conditions. Where it is appropriate and/or necessary to limit use on one trail bed, limited-use and single-use trails should be kept separate and clearly signed" (UM - 1.2).However, the guidelines do not provide specific metrics for these factors.

Other techniques Santa Clara County Parks has implemented are designed to reduce mountain bikers' speeds, including constructing a trail with a grade change so that users approach a ridge nose (where sightlines are poor) or a trail intersection at a gentle uphill in either direction. In general, County Parks constructs undulations in the trail to enhance user experience, control water flow, and moderate speeds. County Parks has found that trails with undulations and sinuosity reduce trail users' speeds.

Santa Clara County Parks also constructs single-track trails with a SWECO trail dozer that builds the trail tread at 5 to 6 feet width on a full bench (all cut cross-section). The trail is then seeded and allowed to re-vegetate to a 3 to 4 feet of width through use (as most users only occupy 3 to 4 feet of the trail tread). However, the 5- to 6-foot bench remains present, providing users a place to stand off the trail to allow other users to pass safely. The 5- to 6-foot bench additionally allows safe passage with dogs on leash (dogs can be held on the far side of the trail while other users pass on the other side).

County Parks has also conducted outreach and education, as well as posting speed limits. Park rangers enforce the speed limit with radar, focusing on areas identified in complaint cards. Regulations are posted that clarify yielding expectations, as well as etiquette for bicyclists and dog walkers.

County Parks reports that their responses have been successful in reducing user conflicts, although it is difficult to track the success of reducing perception of conflicts.

Santa Clara County Parks Lessons Learned

Design Best Practices

- Design and maintain good sight lines – clearing width and trail curvature should assure a 100-foot average sight distance where possible. If sight distances are less than 100 feet, consider safety signs and reduced speed limits.
- Design a grade rise on both directions at trail junctions and in locations with poor sight lines.
- Build undulating trails to reduce speeds, control water flow, and enhance user experience.
- Provide sufficient width based on level of trail – 6 feet is the minimum width to allow two wheelchairs to pass each other.
- Build a wide tread for passing –where narrower than 8 feet, provide wider turn-out/passing areas at regular intervals or grade a wide bench and allow the shoulders to revegetate, leaving a stable passing area.
- Stripe centerlines on paved paths.

Management Best Practices

- Provide signs at regional trail entrances that state applicable use and management regulations with references to appropriate governing ordinances.
- Place use restrictions on trail entrance bollards.
- Sign and enforce a 15 mph speed limit.

C.3.7 Wake County Parks, Recreation and Open Space, North Carolina

Wake County Parks, Recreation and Open Space Department manages 250 acres and 14 miles of shared-use trails open for hiking, mountain biking, and running. Trail surfaces are mineral surface with some aggregate base stone armoring and wood bridges. The agency acts as a steward of trail resources, guiding maintenance and trail renovation efforts conducted by the Triangle Off Road Cyclists (TORC), which is a volunteer user group who builds and maintains the trails. According to the agreement between Wake County Parks, Recreation and Open Space and TORC, the trails are may not be used by horses and riders, automotive vehicles, all-terrain vehicles, trucks, skateboards, rollerblades, or other types of motorized and non-motorized means of personal transport, except by County approval.

Nature of the Problem

Complaints regarding trail use conflicts can occur between hikers and bikers, mainly due to the volume of mountain biking trips on the trail system (over 100,000 per year). The next most common complaint is between two mountain bikers, mostly resulting from perceived right-of-way and speed issues. Hikers often think the mountain bikers are travelling too fast, but most seem to understand that biking is dominant sector represented on Wake County trails. Incidents are most likely to occur on long hills, but there are conflicts on blind turns and intersections as well.

Trails are designed by the local mountain biking community and some of the existing design flaws are being rectified as the IMBA guidelines used for trail renovations. Improvements relate to both improving the sustainability of the trails and to mitigating user conflicts.

Congestion and overcrowding are weekly phenomena on Wake County trails. Complaints regarding natural resources damage and close calls occur approximately monthly, while incidents and non-injury collisions occur on an annual, less-frequent basis.

Solutions

Wake County Parks, Recreation and Open Space has been designing speed chokes in the trails to manage mountain bikers' speeds. Several key trail intersections are triangular to ease flow in and out and to minimize collisions; flares or Y-shaped intersections create more space when two mountain bikers meet. The specific design tends to be unique to each intersection and is impacted by the geography at the intersection, the orientation of the intersecting trails, and other factors. In addition to wider intersections, grassy medians or berms in the middle of the intersection help channel each mountain bike into a particular direction to avoid the other mountain bike. Other trail design improvements, such as improved site lines, chokes, etc., tend to be implemented during re-routes where the existing trail is closed and re-planted with vegetation. The agency typically looks to IMBA guidelines for many of these designs.

Wake County also posts signs indicating standard right-of-way: "cyclists yield to hikers," "downhill yields to uphill," etc. In light of the volume of mountain biking trips, these tactics seem to be having a positive effect.

To maintain sustainable trails, the department closes trails due to wet conditions. The volume of users dictates that they do this to preserve the trail surface even if designed to optimal standards. One section of trail is in a flat, flood-prone area and has been closed to mountain biking.

Several rogue trails in the area were built by the freeride, dirt jumping sector of the sport. The park now has a pump track and jump lines to meet the need in a public park as opposed to on private land without the owner's permission.

Wake County Parks, Recreation and Open Space Lessons Learned

Design Best Practices

- Abide by IMBA trail construction standards for all new work completed.
- Design speed chokes in the trails.
- Build triangular intersections at key locations to ease flow in/ out and minimize collisions.

Management Best Practices

- Post signs indicating standard right of way: "cyclists yield to hikers", "downhill yields to uphill", etc.
- Built a pump track and jump lines in the public park to provide mountain bikers an alternative to building rogue trails.

C.3.8 City of Durango, Colorado

The City of Durango Department of Parks and Recreation manages 2,245 acres of open space and 286 acres of parks. Their jurisdiction includes an estimated 95 miles of trails, including 83 miles of natural surface and 12 miles of concrete and asphalt hard surface trails. Trails are open to non-motorized uses, including mountain and road bicyclists, walkers, hikers, joggers, roller bladders, and skate boarders.

Nature of the Problem

Trail user conflicts are primarily between pedestrians and mountain bikers. Conflicts tend to be associated with high use of the trails system, and are exacerbated by areas of reduced sight distance and a poor trail etiquette. Hikers have expressed concern about mountain bikers' speed, mountain bikers startling hikers when passing them, and mountain bikers not yielding to hikers on the trail. Most conflicts occur on the hard surface primary trail system (Animas River Trail) due to high utilization. Issues on natural surface trails typically occur on a narrow section of trail that has reduced sight distance.

Congestion on the trails is a regular occurrence, with damage to natural resources from users moving off the trail to allow others to pass occurring weekly. Close calls and complaints occur monthly, and accidents only occur approximately once a year. Another challenge has been free ride bikers, who go out into open space and build wooden ramps or jumps, for free ride trails. They are not satisfied with regular mountain bike trails and are looking for more excitement.

Solutions

The Durango Department of Parks and Recreation has responded to trail user incidents by redesigning and reconstructing hard surface trails to correct poor sight distance and known hazards. Trails are designed in accordance with city standards in additional to applicable state and federal standards (AASHTO and IMBA).

The Department also uses the Colorado State Parks handbook *Planning Trails with Wildlife in Mind* (1998). The Department reports successful outcomes from the reconstruction of hazardous areas on the hard surface trails. For example, they have straightened out curves in the trail, using AASHTO standards resulting in fewer issues.

The primary policy and management campaigns focus on share the trail etiquette and leave no trace principles. The Department has also increased public education and outreach of trail etiquette, in partnership with the local trail advocacy group (Trails 2000). Park Rangers and police officers carry out enforcement activities. They travel on foot on the soft surface trails and are strategically deployed due to a tight budget. The Department utilizes seasonal part-time employees during the warmer months and they tend to deploy rangers to the soft surface trails in response to a specific complaint, such as a homeless camp, an illegally built jump, etc. Education and enforcement is ongoing and has had some success. However, education focusing on bikers yielding to pedestrians on the trail has not had much success.

The Department works closely with the local Trails 2000 group to plan, design, construct and manage trails to reduce user conflicts. Trails 2000 also maintains a current database of volunteers for education about trail use and etiquette. Trails 2000 organizes volunteers to construct and maintain the natural surface trail system. The city has a lot of dialogue with this citizen group on anything trail-related. The Department reports that this joint effort has been extremely beneficial to the community.

In response to free ride bikers building illegal trails, the Department and Trails 2000 has met with group representatives to work on a solution to provide them with more exciting riding opportunities. The Department would like to build them a ramp park on sanctioned area, which the free ride bikers have indicated an interest in

City of Durango Lessons Learned

Design Best Practices

- Reconstruct hard surface trails to correct poor sight distance and known hazards.
- Provide alternative stimulating mountain bike trails to discourage illegal trails and improper riding behavior on shared trails,

Management Best Practices

- Carry out enforcement activities by Park Rangers and Police officers.

Outreach Best Practices

- Partner with local volunteer agency to construct and maintain the trail system and perform outreach about trail use and etiquette.

C.3.9 City of Portland Parks and Recreation, Oregon

Portland Parks and Recreation (PP&R) is the steward of 11,000 acres of land at more than 250 locations including a multitude of community and neighborhood parks, natural areas, recreational facilities, gardens, and trails. The Portland region has an estimated 220 miles of regional trails, though not all are managed by PP&R. PP&R manages both single and shared-use trails, which range from soft surface to paved. Shared-use trails include hiking/mountain biking/equestrian, hiking/equestrian, walking/biking, and hiking/mountain biking/equestrian on fire and maintenance roads. Guiding documents include the *Trail Guidelines for Portland's Park System* (2009)[2] and the *Recreational Trail Strategy* (2006).

Nature of the Problem

PP&R reports that most conflicts relate to high speed users such as bike commuters or road bikers conflicting with walkers and others going a slower pace, mountain bikers conflicting with hikers, and off-leash dogs conflicting with runners. Less-frequently conflicts relate to dogs being off leash in general (conflicts with multiple users), dog owners leaving bags of waste on trails, and mountain bikers using walking and hiking trails.

Trail conflicts occur on all days during all daylight hours, but do tend to occur on trails that are too narrow for all the allowed uses. The factors contributing to incidents include off-trail use (by dog walkers, hikers, mountain bikers), dogs being off leash, and trails being too narrow for the allowed uses and number of people using them. Complaints typically come from pedestrians, hikers, and families.

Solutions

Physical responses to trail user conflicts have included posting various types of signage, including trail etiquette, slow down, and designating allowed uses on the trail. These strategies have met with marginal success. PP&R's *Trail Guidelines for Portland's Park System* (2009) provides design and use standards for all types of single use trails, as well as shared-use trails. The trail type pertinent to this study is Type J: hiking/mountain biking/equestrian trails. The guidelines indicate the equestrians and dog walkers are minor uses on hiking/mountain biking trails, while mountain bikers are not allowed on hiking/equestrian trails. Mountain bikers, equestrians, and hikers are also allowed on fire roads or wider gravel trails.

Type J trails should be 4 feet wide with passing areas at a minimum, 10 feet maximum width. The easement width should be 10 feet in addition to the tread width. The discussion noted that these widths allow side-by-side hiking or riding, or room for on-coming or overtaking trail users. Grades should be 0-5 percent slope or up to 12 percent as needed, but the trail does not have the obstacles desired by expert riders. These trails should be ADA-accessible, although the surface is not reliably firm and slip resistant. Sight distance should be 40 to 100 feet, "depending on speed/flow," and turn radii should be 10 feet minimum.

PP&R recently created a new Ranger position for Forest Park (a 5,000 acre natural area). The Ranger can hold education events and write citations. PP&R is currently developing a volunteer program to educate users about appropriate trail use and etiquette. Overall, staff report not having many enforcement tools because of limited staff and budget.

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[2] Portland Parks & Recreation. 2009. *Trail Guidelines for Portland's Park System.* atfiles.org/files/pdf/DesignGuidelinesPortland09.pdf

Portland Parks and Recreation Lessons Learned

Design Best Practices

- Hiking/mountain biking/equestrian trails should be 4 feet wide with passing areas at a minimum, 10 feet maximum width, with 10 feet in addition to the tread for the easement.
- Sight distance on a hiking/mountain biking/equestrian trail should be 40 to 100 feet, "depending on speed/flow," and on a hiking/equestrian trail is 50 to 100 feet.
- Turn radii on a hiking/mountain biking/equestrian trail should be 10 feet minimum.
- Separate users where possible.

Management Best Practices

- Seek additional resources for enforcement.

C.3.10 City of San Luis Obispo, California

The City of San Luis Obispo (SLO) manages approximately 4,000 acres of land, with over 41 miles of trails. Trails are both natural surface and asphalt, and accommodate walking/hiking, dog walking, bicycling, and horse riding. The Ranger Supervisor estimates that the trail system is used by over 500 people per day, with well over 1,000 users on the weekends.

Nature of the Problem

SLO reports receiving few complaints related to user conflicts, approximately one per year. Complaints submitted tend to be related to conflicts between all types of trail users; people walking their dog off-leash, as well as between hikers and bicyclists, particularly due to speed issues. Conflicts most often occur after work or on the weekend, at areas with poor line of sight or locations where bicyclists can build speed.

The Ranger Supervisor estimates that one reported incident occurs each year, although injuries are less frequent.

Solutions

The City has had success with encouraging bicyclists to utilize bells to inform other users of their presence on trails that allow hiking, horse riding, and mountain biking. SLO teamed with the local Central Coast Concerned Mountain Bikers (CCCMB) club, other local advocacy groups, and local bike shops to provide free bells at trailheads. Starting in Spring 2010, the partnership funded the placement of bell boxes at trailheads with simple language reminding bicyclists to use their bells when passing other trail users. The approximate cost was $850 for five bell boxes, with the first bell purchase of 250 bells with logos at $510, which was split with bike shop sponsors. In approximately one year, the program has purchased 3,000 bells. They have received positive response within the bicycling community and from equestrian clubs.

Members of the partnership feel that, while a culture of cooperation between hikers, equestrians, and mountain bikers preceded the program, it continues to foster positive interactions. In particular, the bells and bell boxes create an opportunity for ongoing dialogue in the trails community.

City of San Luis Obispo Lessons Learned

Outreach Best Practices

- Hold bike bell give-aways.
- Partner with local bicycle clubs, advocacy organizations, and bike shops.

Appendix D. User Group Comments

This appendix outlines the outreach conducted to user groups for this Study. Public comments were submitted during the Notice of Preparation (NOP) of the Road and Trail Change-In-Use Evaluation Process (PEIR). Comments related to user conflicts and safety issues on trails or potential solutions are summarized in the first section of this appendix. This Trail User Conflict Study (Study) also sent a notice of the study to a variety of user groups and professional organizations. The notice is provided in the second part of this appendix, followed by a list of resources and agency references recommended by groups and individuals who responded to the notice.

D.1 NOP Scoping Comments

This section provides a summary of the comments received through the PEIR NOP process, followed by a list of the resources provided by people who made comments, which were included in the Literature Review.

D.1.1 Summary of Comments Related to User Conflicts on Trails

Comments from the PEIR NOP process have been categorized into relevant themes which emerged during the review of the comments, including standards for change in use, desire for public involvement, potential techniques to address these issues, concerns about mountain bikers, concerns about enforcement, and general considerations for multiple uses.

D.1.2 Standards for Change in Use

Several comments ask or state a need for a clear set of criteria to establish when it is appropriate for different users to have access to a given trail (Letter O-5, page 2). Others caution against rigid standards that would not be able to consider the variations in conditions on different trails and at different parks.

Need for Standards

- Unclear of the standards that will be used to evaluate a proposed change.
- Need for criteria/standards determining when a trail is suitable for use by specific groups and for shared-use, including trail width, surface treatments, shoulders, grade, sight lines, bicycle design speed, and steepness of adjacent terrain.
- When analyzing existing trail conditions and possibilities to upgrade specific trail segments, wide variations in local conditions impede the development of rigid parameters for trail width, slope, rise, tread, etc.
- Develop specific standards, but address each change of use on a site by site basis.
- Desire for formalized reporting or recordkeeping on incidents.

Factors to Consider

- Concern that the Change in Use process will only result in more allowable uses. Desire for Change in Use to result in downgrading a trail to fewer user types, or not making any changes.

- Hiker/horse trails should not become shared-use if any portion of it is unsafe for shared-use, unless such portions are improved to address this problem.
- Preferred alternative should balance user demands, environmental protection, mitigation and allocation of resources. Consider ratio of miles to size of user group. Inventory trail system so parks can make optimal decisions.
- Assure that the environment, user safety and the quality of the nature experience are all protected.
- Consider the impact of change of use on biological resources; what mitigation will be put in place? Can these be achieved in light of current state budgetary problems?

D.1.3 Public Involvement

- Give public advance notice on specific changes of use.
- Requests better publicizing of meetings, including local newspapers.
- All trail users, including major trail organizations, should be notified of prospective trail changes. Meetings should be arranged at times when people can attend.
- Supports the change in use concept to more effectively manage user conflicts. Concerned about a lack of a mechanism to notify public of proposed changes in use. Will decision-making process and analysis become part of public record? Some way for parties to check the decision-making process.

D.1.4 Potential Techniques to Address Conflict and/or Safety

People offer specific ideas for mitigating safety issues and user conflicts. Examples include the following:

- Signage
- Education
- Speed enforcement
- User etiquette
- Trail management to separate users
- Parallel option to accommodate different user types[1]
- Place traffic calming devices in the trail
- Alternating use days
- One-way trails
- Designating uphill-only routes
- Encourage connections with the community through trail stewardship, collaboration and volunteerism
- Consider social and economic indicators[2] as well as public safety when measuring impacts
- User input via surveys is important to reducing conflicts

[1] As separate from the provision for "major realignment" noted in the checklist

[2] Social and economic effects can be indicators of significant impacts that might otherwise go unaddressed in an EIR, as recognized in the CEQA guidelines at section 15131.

D.1.5 Concerns about Mountain Bikes

Several people commend this effort to consider allowing mountain bikes on additional trails, though many people who provided comments expressed their concern that mountain bikes on trails harms the natural environment, the experience of other users and drives some users off of the trails all together.

One commenter recognizes that there are many reasons for unauthorized trail use by mountain bikers, including cyclists being arbitrarily excluded from trails, failure to provide desired trails, or the need for more legitimate trail access. In most cases, unauthorized trail use will not be diminished unless the root causes are identified and dealt with in a constructive manner (Letter O-9, page 3).

Commends the change in use effort

- Supports the change in use program. Mountain biking is positive for the community, involves youth in the outdoors. Mountain bikers also want to see the nature in the forests and mountains preserved in their natural state.
- Consider potential benefits of the change of use, such as: reducing vehicle trips if, by opening a trail for additional uses, more visitors have direct park access without the need for a vehicle; reducing the number of interactions between trail users on any individual route by distributing park visitors over a broader area; increasing the pool of volunteers available for trail maintenance, monitoring and restoration.
- To the extent possible, impacts of additional users should be based on available scientific data. Consider per capita impact of mountain bikes vs. other users. Also opening a trail to mountain bikes may cause mountain bike use of other trails in the park to decrease.

Incompatibility with other users

- Speed differential of mountain bicyclists discourages trail use by equestrians and hikers, high speeds lead to inability to stop for other users and spooks horses.
- Mountain bikes are driving off horses, hikers and elderly trail users.
- Extremely concerned that historical users who travel by foot will be displaced if non-motorized vehicles are allowed on foot paths.
- Proposed change in use document appears biased in favor of mountain bikers as compared to the traditional trail user public.

Types of trails

- Fire roads are appropriate for mountain biker use due to adequate width.
- Mountain bikes should only be allowed on wide trails intended for their use. Good lines of site are essential.
- Minimum requirements of well designed shared-use trails should be at least a 72 inch width, good visibility and no blind corners to accommodate room for all users.
- Should continue to share vehicular width roads with bikes, but keep them off other trails.

- Provide a diversity of trail experience for mountain bicyclists; Mountain bikes should not be limited to flat, smooth, obstacle-free trails; Changes should consider equity, diversity of trail experience and connectivity.

D.1.6 Enforcement

Many people point out that there is a danger of new rules being ineffective if there is not budget to enforce them.

- Consider the need for enforcement and the likelihood of it taking place before implementing new rules.
- Concerns about mountain bicyclists not adhering to alternate day or signed exclusions without clear means of enforcement.
- Consider making it a criminal offense with significant penalties to discourage destructive bike riders from continued use of public parks, if there were funds for patrolling and enforcement.
- Desire for an enforceable way of managing the large volume of users on trails.
- Solutions should consider the reality of local budgets, and that there is little money available for maintenance and enforcement. Therefore, consider building separate trails for mountain bikes.

D.1.7 General Considerations of Different Users

Several comments request the consideration of differences in how different groups use trails (i.e., distance traveled, seasonal users, etc.) when developing solutions. Furthermore, different users have different ideas of what they would like their trail experience to be (i.e., hikers wanting a quiet natural experience free of motorized or mountain bikes).

- Draw a distinction between urban and remote parks – considering the distance different user types penetrate a trail system in a given amount of time.
- Recognize seasonal use and off-season use of trails (e.g., hunters in the fall, ski trails in the winter, etc.).
- Address impact of changes of use on user experience by different user types and site conditions (desired aesthetic experiences).

D.1.8 References and Attachments Provided in NOP Comment Letters

The following is a list of references recommended and provided in comment letters. These resources are included in the Literature Review discussed in Appendix B.

- Impact of Mountain Biking - Palos Verdes Nature Preserve, compiled by Lynn Brown.
- Article "Trail Wars at Annadel State Park" dated July 6, 2010
- Summary of personal reports of incidents involving bikers, compiled from Park Watch.org
- CET&LC Safety Considerations for Multi-use Trails.
- Motion to Intervene, Lake Oroville Relicensing, Federal Energy Regulatory Commission, March 31, 2006
- Hoger & Chavez (1998). Conflict and management tactics on the trail. Parks & Recreation, 33(9), 41-49.
- Moore, (1994). Conflicts on Multiple-Use Trails: Synthesis of Literature and State of Practice. Washington, D.C.: Federal Highway Administration.
- Ramthum (1995). Factors in user group conflict between hikers and mountain bikers. Leisure Sciences, 17(3), 159-170
- Schneider (2000). Revisiting and revising recreation conflict research. Journal of Leisure Research, 32(1), 129-132.
- Vaske, Donnelly, Karin & Laidlaw (1995). Interpersonal versus social-values conflict. Leisure Sciences, 17(3), 205-222
- Marion & Wimpey, (2007). Environmental Impacts of Mountain Biking: Science Review and Best Practices. Originally published in Managing Mountain Biking: IMBA's Guide to Providing Great Riding (2007).
- Bjorkman, Alan. 1996. Off Road Bicycle and Hiking Trail User Interactions: A Report to the Wisconsin Natural Resources Board. Wisconsin Department of Natural Resources: Bureau of Research.
- Chiu, Luke and Kriwoken, Lorne. Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia. *Annals of Leisure Research*, (in press).
- Crockett, Christopher S. 1986. Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park. Santa Clara County (CA) Parks Department.
- Gander, Hans and Ingold, Paul. 1996. Reactions of Male Alpine Chamois Rupicapra r.rupicapra to Hikers, Joggers and Mountain Bikers. *Biological Conservation* 79:107 - 109.
- Goeft, Ute and Alder, Jackie. 2001. Sustainable Mountain Biking: A Case Study from the Southwest of Western Australia. *Journal of Sustainable Tourism* 9(3): 193 - 211.

- Herrero, Jake and Herrero, Stephen. 2000. Management Options for the Moraine Lake Highline Trail: Grizzly Bears and Cyclists.
- Papouchis, Christopher M. and Singer, Francis J. and Sloan, William. 2001. Responses of Desert Bighorn Sheep to Increased Human Recreation. *Journal of Wildlife Management* 65(3): 573 - 582.
- Spahr, Robin. 1990. Factors Affecting the Distribution of Bald Eagles and Effects of Human Activity on Bald Eagles Wintering Along the Boise River. Boise State University.
- Taylor, Audrey R. and Knight, Richard L. 2003. Wildlife Responses to Recreation and Associated Visitor Perceptions. *Ecological Applications* 13(4): 951 - 963.
- Thurston, Eden and Reader, Richard J. 2001. Impacts of Experimentally Applied Mountain Biking and Hiking on Vegetation and Soil of a Deciduous Forest. *Environmental Management* 27(3): 397 - 409.
- Weesner, Meg. 2003. Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona, National Park Service.
- Wilson, John P. and Seney, Joseph. 1994. Erosional Impacts of Hikers, Horses, Motorcycles and Off-Road Bicycles on Mountain Trails in Montana. *Mountain Research and Development* 47(1): 77 - 88.
- Environmental Impacts of Mountain Biking: Science Review and Best Practices. http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices.By Jeff Marion and Jeremy Wimpey.2007.
- http://www.imba.com/resources/research/environmental-impacts
- http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices
- www.americantrails.org

D.1.9 Study Notice

A notice of the study and solicitation for additional objective documents and data on the subject was sent to the people who signed in at the PEIR scoping sessions as well as the groups noted in Table D-1. The notice is provided, as well as a list of resources and agency references recommended by respondents.

Table D-1. Solicitation Notice Outreach

Group	Method
American Trails website	Posted
Association of Pedestrian and Bicycle and Professionals (APBP)	E-mail to list serve
Individuals who signed into the NOP scoping workshops	E-mailed
International Mountain Bicycling Association (IMBA)	E-mailed to staff
Rails-to-Trails Conservancy (RTC)	Sent in member April e-newsletter
Responsible Organized Mountain Peddlers (ROMP)	E-mailed to staff
Sierra Club	E-mailed to staff

Notice

The study notice is provided on the following pages.

• NOTICE •

California Department of Parks and Recreation Seeks Trail Conflict/Safety Data and Documents

The Department is conducting a Statewide Roads and Trails Change-in-Use Program Programmatic Environmental Impact Report (PEIR). We are conducting background research regarding trail use conflict and safety issues and solutions.

We are seeking hard data and documented practices, including success stories and failures. THIS IS NOT A TRAIL USER OPINION SURVEY; rather it is an attempt to find the most complete and objective documentation of the issues, and the best practices for addressing them. **The goal is to complete the research collection and document review by April 30, 2011.**

We have already received several references and resources on this topic from those who commented on the scope for the PEIR (listed in Attachment A). Attachment B presents our initial working list of reference documents and data (it may duplicate some resources in Attachment A). We would like any other study, strategy, contact, or other source of information on techniques for managing multiple user types on trails and shared-use paths.

Additional data, documents, or suggestions, or questions about the research should be directed to Hannah Kapell, Research Coordinator: hannahkapell@altaplanning.com or (510) 540-5008 x111.

CALIFORNIA STATE PARKS ASCENT alta PLANNING + DESIGN

Attachment A: References and Attachments Provided in NOP Comment Letters

NOP Comment Letter O-5 Attachments:

- D. Impact of Mountain Biking - Palos Verdes Nature Preserve, compiled by Lynn Brown.
- E. Article "Trail Wars at Annadel State Park" dated July 6, 2010
- F. Summary of personal reports of incidents involving bikers, compiled from Park Watch.org
- G. CET&LC Safety Considerations for Multi-use Trails.
- H. Motion to Intervene, Lake Oroville Relicensing, Federal Energy Regulatory Commission, March 31, 2006

NOP Comment Letter O-9:

For additional consideration of trail conflict and the research conducted on its causes and solutions, please refer to the following sampling of studies:

- Hoger & Chavez (1998). Conflict and management tactics on the trail. Parks & Recreation, 33(9), 41-49.
- Moore, (1994). Conflicts on Multiple-Use Trails: Synthesis of Literature and State of Practice. Washington, D.C.: Federal Highway Administration.
- Ramthum (1995). Factors in user group conflict between hikers and mountain bikers. Leisure Sciences, 17(3), 159-170
- Schneider (2000). Revisiting and revising recreation conflict research. Journal of Leisure Research. 32(1), 129-132.
- Vaske, Donnelly, Karin & Laidlaw (1995). Interpersonal versus social-values conflict. Leisure Sciences, 17(3), 205-222

Some examples of research conducted that compare the effects of bicyclists with other trail users:

- Marion & Wimpey, (2007). Environmental Impacts of Mountain Biking: Science Review and Best Practices. Originally published in Managing Mountain Biking: IMBA's Guide to Providing Great Riding (2007).
- Bjorkman, Alan. 1996. Off Road Bicycle and Hiking Trail User Interactions: A Report to the Wisconsin Natural Resources Board. Wisconsin Department of Natural Resources: Bureau of Research.
- Chiu, Luke and Kriwoken, Lorne. Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia. *Annals of Leisure Research*, (in press).
- Crockett, Christopher S. 1986. Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park. Santa Clara County (CA) Parks Department.
- Gander, Hans and Ingold, Paul. 1996. Reactions of Male Alpine Chamois Rupicapra r.rupicapra to Hikers, Joggers and Mountainbikers. *Biological Conservation* 79:107 - 109.
- Goeft, Ute and Alder, Jackie. 2001. Sustainable Mountain Biking: A Case Study from the Southwest of Western Australia. *Journal of Sustainable Tourism* 9(3): 193 - 211.
- Herrero, Jake and Herrero, Stephen. 2000. Management Options for the Moraine Lake Highline Trail: Grizzly Bears and Cyclists.
- Papouchis, Christopher M. and Singer, Francis J. and Sloan, William. 2001. Responses of Desert Bighorn Sheep To Increased Human Recreation. *Journal of Wildlife Management* 65(3): 573 - 582.
- Spahr, Robin. 1990. Factors Affecting The Distribution Of Bald Eagles And Effects Of Human Activity On Bald Eagles Wintering Along The Boise River. Boise State University.
- Taylor, Audrey R. and Knight, Richard L. 2003. Wildlife Responses to Recreation and Associated Visitor Perceptions. *Ecological Applications* 13(4): 951 - 963.
- Thurston, Eden and Reader, Richard J. 2001. Impacts of Experimentally Applied Mountain Biking and Hiking on Vegetation and Soil of a Deciduous Forest. *Environmental Management* 27(3): 397 - 409.
- Weesner, Meg. 2003. Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona, National Park Service.
- Wilson, John P. and Seney, Joseph. 1994. Erosional Impacts of Hikers, Horses, Motorcycles and Off-Road Bicycles on Mountain Trails in Montana. *Mountain Research and Development* 47(1): 77 - 88.

NOP Comment Letter O-11 attachments/links:

- Environmental Impacts of Mountain Biking: Science Review and Best Practices. http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices. By Jeff Marion and Jeremy Wimpey. 2007.
- http://www.imba.com/resources/research/environmental-impacts
- http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices

NOP Comment Letter I-14:

- www.americantrails.org (provides information on environmental impacts caused by various user groups)

Attachment B: Resources Collected to Date

Author	Org/Agency	Title
AASHTO	AASHTO	*Guide for the Development of Bicycle Facilities*
Alta Planning & Design	East Bay Regional Park District	*DRAFT Narrow Natural Surface Trails Managing Multiple Use*
Bjorkman, Alan	Wisconsin Bureau of Natural Resources: Bureau of Research	*Off Road Bicycle and Hiking Trail User Interactions: A Report to the Wisconsin Natural Resources Board*
Bondurant, J., L.Thompson et. Al.	N/A	*Trail Planning for California Communities*
Brown, Lynn	?	*Impact of Mountain Biking – Palos Verdes Nature Preserve*
CA State Parks	CA State Parks	*Park Watch Reports for Folsom Lake Pioneer Express Trail*
CA State Parks	CA State Parks	*California Recreational Trails Plan*
CA State Parks	CA State Parks	*Best Management Practices For Road Rehabilitation: Road to Trail Conversion*
CA State Parks	CA State Parks	*State Parks Policy on Roads and Trails Change in Use*
CA State Parks	CA State Parks	*Trail Manager's Toolbox*
California Equestrian Trails & Lands Coalition	California Equestrian Trails & Lands Coalition	*Safety Considerations for Multi-use Trails*
Caltrans	Caltrans	*Bikeway Planning and Design*
Caltrans	Caltrans	*Manual on Uniform Traffic Control Devices*
Caltrans	Caltrans	*Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedure*
Carothers, P., J. Vaske, & M. P. Donnelly		*Social values versus interpersonal conflict among hikers and mountain bikers*
Cessford, G.R.	International Mountain Bike Association	*Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand*
Chiu, Luke and Kriwoken, Lorne		*Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia*
Coalition for the Capitol Crescent Trail	Coalition for the Capitol Crescent Trail	*Capitol Crescent Trail User Survey*
Cole, David N.	Aldo Leopold Wilderness Research Institute	*Visitor and Recreation Impact Monitoring: Is it Lost in the Gulf Between Science and Monitoring?*
Crockett, Christopher S	Santa Clara County (CA) Parks Dept.	*Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park*
FERC	FERC	*Notice of Motion, Motion to Intervene, Protest and Comments . . .*
FHWA	FHWA	*BIKESAFE Website*
FHWA	FHWA	*Evaluation of Safety, Design and Operation of Shared Use Paths: Final Report*
Gander, Hans and Ingold, Paul		*Reactions of Male Alpine Chamois Rupicapra r.rupicapra to Hikers, Joggers and Mountainbikers*
General Manager of Engineering Services	City of Vancouver, BC	*Speed Limits on Recreational Bicycle Paths*
Goeft, Ute and Alder, Jackie		*Sustainable Mountain Biking: A Case Study from the Southwest of Western Australia*
Hoger & Chavez		*Conflict and management tactics on the trail*
Jackson, S. A., Haider, W., & Elliot, T.		*Chilkoot Trail National Historic Site, British Columbia*
Jellum, C. M.	Central Washington University	*Managing Mountain Bike Recreation and User Conflicts: A Case Study on Mt. Baker-Snoqualmie National Forest, Washington State*
Johnson, Julie		*Trail wars at Annadel State Park*
Litman, Tod	bicyclinginfo.org	*Share the Trail: Minimizing User Conflicts on Non-Motorized Facilities*
MN Dept of Natural Resources	MN Dept of Natural Resources	*Trail Planning, Design, and Development Guidelines*
Moore, R. L.	Federal Highway Administration	*Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*
Papouchis, Christopher M. and Singer, Francis J. and Sloan, William		*Responses of Desert Bighorn Sheep To Increased Human Recreation*
Ramthum		*Factors in user group conflict between hikers and mountain bikers*
Reynolds, C., M. Harris, K. Teschke, P. Cription, and M. Winters.	N/A	*The Impact of Transportation Infrastructure on Bicycling Injuries and Crashes: A Review of the Literature*
Rodgers, G.B.		*Factors Associated with the Crash Risk of Adult Bicyclists*
Ryan, K.L. (Ed)	N/A	*Trails for the Twenty-First Century*
Schneider		*Revisiting and revisign recreation conflict research*

Appendix D.

Author	Org/Agency	Title
Spahr, Robin	Boise State University	*Factors Affecting The Distribution Of Bald Eagles And Effects Of Human Activity On Bald Eagles Wintering Along The Boise River*
Stearns, R., B. Woodcock & J. Pflaum	National Trails Training Partnership	*Trail Maintenance and Management: We Built It and They Came*
Taylor, Audrey R. and Knight, Richard L		*Wildlife Responses to Recreation and Associated Visitor Perceptions*
Thurston, Eden and Reader, Richard J.		*Impacts of Experimentally Applied Mountain Biking and Hiking on Vegetation and Soil of a Deciduous Forest*
Tinsworth, D., S. Cassidy, C. Polen		*Bicycle-related injuries: Injury, hazard, and risk patterns*
Transporation Research Board	Transportation Research Board	*Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedures*
Transportation Alternatives	Transportation Alternatives	*The 15-Mile-Per-Hour Cycling Speed Limit*
USDA USFS	USDA USFS	*Trail Construction and Maintenance Notebook*
Vaske, Donnelly, Karin & Laidlaw		*Interpersonal versus social-values conflict*
Webber, P. (Ed)	International Mountain Bike Association	*Managing mountain biking. IMBA's guide to providing great riding*
Weesner, Meg	National Park Service	*Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona*
Wilson, John P. and Seney, Joseph		*Erosional Impacts of Hikers, Horses, Motorcycles and Off-Road Bicycles on Mountain Trails in Montana*
International Mountain Bike Association	International Mountain Bike Association	*Trail Solutions: IMBA's Guide to Building Sweet Singletrack*
Sprung, Gary	International Mountain Bike Association	*Natural Resource Impacts of Mountain Biking: A summary of scientific studies that compare mountain biking to other forms of trail travel*
Marion, Jeff & Jeremy Wimpey	International Mountain Bike Association	*Environmental Impacts of Mountain Biking: Science Review and Best Practices*
Wimpey, Jeremy	International Mountain Bike Association	*Environmental Impacts of Mountain Biking: Science Review and Best Practices*

D.2 Comments Received

Table D-2 lists the agencies and trails that user groups or individuals recommended for inclusion in the Agency Survey. Table D-3 following lists the literature sources recommended.

Table D-2. Agencies Recommended by User Groups and Individuals

Source	Affiliation	Agency
Macdonald, Stewart	American Trails Magazine	Jefferson County, CO
Macdonald, Stewart	American Trails Magazine	ROMP www.romp.org
Macdonald, Stewart	American Trails Magazine	Griffith Park, Los Angeles, CA
Macdonald, Stewart	American Trails Magazine	East Bay Municipal Utility District
Macdonald, Stewart	American Trails Magazine	East Bay Regional Parks District
Cohen, Laura	Rails-to-Trails Conservancy	Rivers, Trails & Conservation Assistance Program, National Park Service, Barbara Rice
Cohen, Laura	Rails-to-Trails Conservancy	East Bay Area Trails Council
Cohen, Laura	Rails-to-Trails Conservancy	East Bay Regional Park District, Jim Townsend
Sullivan, Jim	Responsible Organized Mountain Pedalers (ROMP)	City of Palo Alto Lester Hodges,, Supervising Ranger Lester.Hodgins@cityofpaloalto.org
Sullivan, Jim	Responsible Organized Mountain Pedalers (ROMP)	Golden Gate National Recreation Area, National Park Service, George Durgerian, Park Ranger, Public Affairs & Special Events
Sullivan, Jim	Responsible Organized Mountain Pedalers (ROMP)	Enid Pearson Arastradero Preserve, Palo Alto
Bernhardt, Chris	International Mountain Bicycling Association (IMBA)	Garrett Villanueva, Lake Tahoe Basin Management Unit
Bernhardt, Chris	International Mountain Bicycling Association (IMBA)	Rob Perrin, BLM
Bernhardt, Chris	International Mountain Bicycling Association (IMBA)	Jeremy Wimpey, PhD, Applied Trails Research
Bernhardt, Chris	International Mountain Bicycling Association (IMBA)	Jim Schmid, USFS
Bernhardt, Chris	International Mountain Bicycling Association (IMBA)	Woody Keen, Trail Dynamics

Table D-3. Literature Recommended by User Groups and Individuals

Source	Affiliation	Resource/Publication
Macdonald, Stewart	American Trails Magazine	Moore, R. L.1994. *Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*
Vandeman, Michael		Vandeman, Michael 2004.*The Impacts of Mountain Biking on Wildlife and People -- A Review of the Literature.*
Vandeman, Michael		City of St. Louis Board of Public Service. 2008. *Forest Park - Access, Circulation, and Parking Study*
Vandeman, Michael		Vandeman, Mike. No Date. *Letter to author of the paper, "Assessing and Understanding Trail Degradation: Results from Big South Fork National River and Recreation Area"*
Vandeman, Michael		Vandeman, Mike. 2006. *A Critique of "A Comparative Study of Impacts to Mountain Bike Trails in Five Common Ecological Regions of the Southwestern U.S." (White et al 2006).*
Brown, Lynn	Equestrian Trails Inc.	Mountain Bike Task Force for the City of Los Angeles. 2000. *Majority Report.*
Beyaert, Bruce	Trails for Richmond Action Committee (TRAC)	California Public Resources Code, *Section 5850(e)*
Beyaert, Bruce	Trails for Richmond Action Committee (TRAC)	Zero Motorcycles, http://www.zeromotorcycles.com/
Zerger , Cindy	Center for Changing Landscapes	Center for Changing Landscapes and the Department of Forests. 2011. *Minnesota's Network of Parks & Trails.*
Zerger , Cindy	Center for Changing Landscapes	Associate Dean Greg Lindsey of the Humphrey School http://www.hhh.umn.edu/people/glindsey/index.html
Zsutty Yves	Trail Manager, City of San Jose, Department of Parks, Recreation & Neighborhood Services	City of San Jose. 2011. *Council Agenda 03-29-11: Trail Safety Enhancements.*
Zsutty Yves,	Trail Manager, City of San Jose, Department of Parks, Recreation & Neighborhood Services	City of San Jose Trail Program. 2010. *Trail Signage Guidelines*
Bible, Sue		American Competitive Trail Horse Assoc site --www.actha.us
Bible, Sue		www.perfecthorse.com
Villwock-Witte, Natalie	Research Scientist, Western Transportation Institute	Moore, R. L.1994. *Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*
Koontz, Clif	Program Director, Ride with Respect	Moore, R. L.1994. *Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*
Koontz, Clif	Program Director, Ride with Respect	Koontz, C. R. 2005. *Recreational Trail Conflict: Achieving Equity Through Diversity*
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Weir, Donald. . A Guide to the Impacts of Non Motorized Trail Use. Don Weir and Associates- Edmonton Alberta Canada.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Lanz, Michael. 2001. *Trail Shock.* AMC Outdoors Magazine, April 2001.

Source	Affiliation	Resource/Publication
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Colorado State Parks. 1997. *Trails and Wildlife Bibliography*. Colorado State Parks, Trails Program.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Goldstein, S. S. 1987. *Mountain Bikes and the Parks: Mitigation of Safety and User Conflict Problems*. Unpublished undergraduate paper.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Santa Clara County. 1989. *Adoption of Negative Declaration and Policy Related to New Off Road Bicycle Trail in County Parks.*
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Sloan, D. and T. Fletcher (editors). 1989. *Environmental Management for the East Bay*. Report of the Environmental Sciences Senior Seminar.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Ford, R. 1989. *Mountain Bike Survey Update*. Unpublished Report, Santa Barbara Ranger District, Los Padres National Forest.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Keller, K.D. 1990. *Mountain bikes on public land: A manager's guide to the state of the practice.* Washington DC: Bicycle Federation of America.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Pearce, Brian. 1990. *Mountain Biking on the Niagara Escarpment*. University of Waterloo Faculty of Environmental Studies, School of Urban and Regional Planning.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Watson, A.E., D.R. Williams and J. J. Daigle. 1991. *Sources of Conflict Between Hikers and Mountain Bike Riders in the Rattlesnake NRA*. Journal of Park and Recreation Administration 9: 59-71.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Kulla, Andy. 1991. *A New Perspectives Approach in National Forest Recreation and its Application to Mountain Bike Management.*
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	North Carolina Division of Parks and Recreation. 1993. *Results of the Two Year Mountain Bicycle Trail Study.* North Carolina Division of Parks and Recreation, Department of Environment, Health and Natural Resources.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Hollenhorst, S. J., Schuett, M. A., Olson, D. & Chavez, D. 1995. *An Examination of the Characteristics, Preferences, and Attitudes of Mountain Bike Users of the National Forests.* Journal of Park and Recreation Administration, 13(3): 41-51.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Hollenhorst, Schuett and Olsen. 1995. *A National Study of Mountain Biking Opinion Leaders: Characteristics, Preferences, Attitudes and Opinions.*
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Cessford, G.R.1995. *Off-Road Impacts of Mountain Bikes: A Review and Discussion.* Science and Research Series no. 92.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Chavez, D. J.1996. *Mountain Biking: Issues and Actions for USDA Forest Service Managers*. Res. Paper PSW-RP-226-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	*Trends* US Department of Interior, NPS, National Recreation and Park Association, Special Issue on Mountain Biking Management and Research, 34(3), 1997
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Symmonds, M. C., W.E. Hammit and V. L. Quisenberry. 2000. *Managing Recreational Trail Environments for Mountain Bike User Preferences.* Environmental Management 25(5): 549-571.

Source	Affiliation	Resource/Publication
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Hendricks, Ramthum and Chavez. 2000. *Mountain Bicyclists' Behavior in Social Trail Etiquette Situations*. Kyle, Gerard, comp., ed. 2000. Proceedings of the 1999 Northeastern Recreation Research Symposium. Gen. Tech. Rep. NE-269. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 194-198.
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Rothman. 2001. *The War of the Future*. The George Wright Forum 18(1).
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Locke, Justin. No Date. *Access to our Public Lands: Mountain Bikes, the Concept of Public Ownership, and the Fatal Flaw in Bicycle Trails Council of Marin v. Babbitt.*
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	Cessford, G.R. 2002. *Monitoring and Management of Visitor Flows in Recreational and Protected Areas. .*
Jim Hasenauer	International Mountain Bicycling Association (IMBA)	J. L. Marion. 2006. *Assessing and Understanding Trail Degradation: Results from Big South Fork National River and Recreational Area.* NPS. USGS Patuxent Wildlife Research Center, Cooperative Park Studies Unit, Virginia Tech Dept. of Forestry.

Appendix E. **Annotated Bibliography**

This appendix summarizes literature relevant to the subject of trail user conflicts or safety issues. Each summary includes a brief description of the study, including background on the researcher, affiliated organizations, or other available impetus or context for the study. The discussion also notes which groups tend to cite the article, whether it is posted or referenced from a user group website. All articles in the academic category are peer-reviewed. Key information from each document is provided, as well as the critique of the document, as described below.

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Table E-1. Summary of Sources Included in Literature Review

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
Federal								
1	AASHTO	*Guide for the Development of Bicycle Facilities*	1999		AASHTO			
2	Bowker, J. M., and D. B. English	*Mountain Biking at Tsali: An Assessment of Users, Preferences, Conflicts, and Management Alternatives*	2002	U.S. Department of Agriculture Forest Service, Southern Research Station. General Technical Report SRS-59	US Forest Service	http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs059.pdf		
3	Chavez, D. J.	*Mountain Biking: Issues and Actions for USDA Forest Service Managers*	1996a	Res. Paper PSW-RP-226-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.	US Forest Service	http://www.fs.fed.us/psw/publications/documents/psw_rp226/psw_rp226.pdf	User rec	IMBA
4	FHWA	*Evaluation of Safety, Design and Operation of Shared Use Paths: Final Report*	2006		FHWA	http://www.fhwa.dot.gov/publications/research/safety/pedbike/05137/		
5	FHWA	*BIKESAFE Website*	No Date		FHWA	http://www.bicyclinginfo.org/bikesafe/		
6	Hendricks, Ramthum and Chavez	*Mountain Bicyclists' Behavior in Social Trail Etiquette Situations*	2000	Proceedings of the 1999 Northeastern Recreation Research Symposium. Gen. Tech. Rep. NE-269. Newtown Square, PA: U.	Wildland Recreation and Urban Cultures Research Unit of the Pacific Southwest Research Station	Hard copy provided by user	User rec	IMBA
7	Hesselbarth, W., B. Vachowski, M. Davies	*Trail Construction and Maintenance Notebook*	2007	FHWA and United States Forest Service, FSH2309.18	US Forest Service	http://www.fhwa.dot.gov/environment/fspubs/07232806/toc.htm		

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
8	Hollenhorst, S. J., Schuett, M. A., Olson, D. & Chavez, D.	*An Examination of the Characteristics, Preferences, and Attitudes of Mountain Bike Users of the National Forests*	1993	Journal of Park and Recreation Administration, 13(3): 41-51			User rec	IMBA
9	Kulla, A.	*A New Perspectives Approach in National Forest Recreation and its Application to Mountain Bike Management*	1991	Ohio State University's Professional Development for Outdoor Recreation Managers/Planners Shortcourse	Lolo National Forest	Hard copy provided by user	User rec	IMBA
10	Moore, R. L.	*Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*	1994		FHWA	www.americantrails.org/resources/ManageMaintain/MooreConflictMgmt.html	User rec	IMBA
11	National Park Service, Department of the Interior	*Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona*	2003		National Park Service			
12	Rouphail, N. J. Hummer, J. Milazzo II, P. Allen.	*Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedure*	1998		FHWA	http://katana.hsrc.unc.edu/cms/downloads/CapacityAnal_PedBike_SignalizedIntersections.pdf		
13	Sprinkle Consulting	*Characteristics of Emerging Road and Trail Users and Their Safety.*	2004		FHWA-HRT-04-103, Federal Highway Administration, McLean, VA, October 2004.	http://www.fhwa.dot.gov/publications/research/safety/04104/roadstechbrief.pdf		
14	Tuler, S., Golding, D., Krueger, R.J.	*A Review of the Literature for a Comprehensive Study of Visitor Safety in the National Park System*	2002	George Perkins Marsh Institute, Clark University, MA	National Park Service	http://www.californiatrails.org/documents/NationalParkServiceSafety.pdf		

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
15	USFS	*Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds*	2007	0723-2816-MTDC	In cooperation with FHWA	http://www.fhwa.dot.gov/environment/fspubs/07232816/pdf07232816dpi72all.pdf		
General								
16	Birkny, R. C.	*Lightly on the Land: The SCA Trail-Building and Maintenance Manual*	1996					
17	Flink, C. A., and R. M. Searns	*Greenways: A Guide to Planning, Design and Development*	1993	Washington, D.C.: Island Press.				
18	Flink, C., Olka, K., Searns, R., Rails-to-Trails Conservancy	*Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails*	1993	Washington, D.C.: Island Press.	Island Press			
19	MN Dept of Natural Resources	*Trail Planning, Design, and Development Guidelines*	2006	St. Paul, MN: State of Minnesota.	MN Dept of Natural Resources			
20	North Carolina Division of Parks and Recreation	*Results of the Two Year Mountain Bicycle Trail Study*	1993	North Carolina Division of Parks and Recreation, Department of Environment, Health and Natural Resources		Hard copy provided by user	User rec	IMBA
21	Parker, T. S.	*Natural Surface Trails by Design: Physical and Human Design Essentials of Sustainable, Enjoyable Trails*	2004	Boulder, CO: Natureshape.				

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
State								
22	Bondurant, J., L.Thompson et. al.	*Trail Planning for California Communities*	2009	Solano Press Books				
23	CA State Parks	*California State Parks Accessibility Guidelines*	2005					
24	Caltrans	*Highway Design Manual Chapter 1000: Bikeway Planning and Design*	2009	California Highway Design Manual (2009): 1000	Caltrans	http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm		
25	Caltrans	*Manual on Uniform Traffic Control Devices*	2011		Caltrans	http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2011_draftrevisions.htm		
Local								
26	Anderson, D.H., Lime, D. W., and T.L. Wang	*Maintaining the Quality of Park Resources and Visitor Experiences*	1998	St. Paul: University of Minnesota Extension Service.	University of Minnesota	http://cpsp.cfans.umn.edu/publications/revtactics_handbook.pdf		
27	Bauer, M.	*Recreation Conflict at Six Boulder County Parks and Open Space Properties: a Baseline Study*	2004		Boulder County Parks and Open Space	http://www.californiatrails.org/documents/ConflOutdoorRec2.pdf		
28	Chiu, Luke and L. Kriwoken	*Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia*	2003	Annals of Leisure Research. 6:4, 339-361	University of Tasmania, Australia	http://eprints.utas.edu.au/2948/1/Managing_Recreational_Mountain_Bike.pdf		IMBA
29	City of Portland Parks & Recreation	*Trail Design Guidelines for Portland's Park System*	2009		City of Portland, OR	atfiles.org/files/pdf/DesignGuidelinesPortland09.pdf		

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
30	City of San Jose	*Council Agenda 03-29-11: Trail Safety Enhancements*	2011			http://www.sanjoseca.gov/clerk/Agenda/20110329/20110329_0501.pdf	User rec	
31	City of San Jose Trail Program	*Trail Signage Guidelines*	2010			http://www.sjparks.org/Trails/Reports/TrailSignageGuidelines_low-res.pdf	User rec	
32	City of St. Louis Board of Public Service	*Forest Park - Access, Circulation, and Parking Study*	2008		City of St. Louis Board of Public Service	http://stlouis.missouri.org/citygov/parks/forestpark/ParkingReport.pdf	User rec	
33	City of Vancouver, B.C. General Manager of Engineering Services	*Speed Limits on Recreational Bicycle Paths*	1995		City of Vancouver, BC	http://vancouver.ca/ctyclerk/cclerk/951207/vtc1.htm		
34	East Bay Regional Parks District (EBPRD)	*Narrow Natural Surface Trails Managing Multiple Use*	2011			http://www.ebparks.org/files/ebrpd_Narrow_Trail_Study_FINAL_03_24_2011.pdf		
35	Midpeninsula Regional Open Space District	*Trail Use Guidelines and Mitigation Measures*	1993					
36	Mosedale, J.	*Mountain Biking in the Canadian Rocky Mountains: A situational analysis*	2002	The Canadian Environmental Network				
37	Santa Clara County	*Adoption of Negative Declaration and Policy Related to New Off Road Bicycle Trail in County Parks*	1989			Hard copy provided by user	User rec	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
38	Searns, R., B. Woodcock & J. Pflaum	*Trail Maintenance and Management: We Built It and They Came*	2007		National Trails Training Partnership	www.americantrails.org/resources/ManageMaintain/ManageMCSearns.html		
39	Santa Monica Mountains National Recreation Area	*Santa Monica Mountains Area Recreational Trail Coordination Project*	1997			http://www.nps.gov/samo/parkmgmt/upload/SmmartTOCExecSumProjOV.pdf		
Academic								
40	Bradsher, D.J.	*The Relationship Between Past Experience and Multiple Use Trail Conflict*	2003	Masters' Thesis	North Carolina State University	http://www.californiatrails.org/documents/RelationshipBetwConflict.pdf		
41	Carothers, P., J. Vaske, & M. P. Donnelly	*Social values versus interpersonal conflict among hikers and mountain bikers*	2001	Leisure Sciences 23(1): 47-61.		http://bolt.lakeheadu.ca/~bpaynewww/3812/carothers.pdf		IMBA
42	Cessford, G.R.	*Off-Road Impacts of Mountain Bikes: A Review and Discussion*	1995b	Science and Research Series no. 92	New Zealand Department of Conservation		User rec	IMBA
44	Cessford, G.R.	*Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand*	2002	in Proceedings from conference at Bodenkultur University, Vienna Austria 2002. Also to be printed in Journal of Nature Conservation, Germany	International Mountain Bike Association	http://www.imba.com/resources/research/trail-science/perception-and-reality-conflict-walkers-and-mountain-bikes-queen-charlotte	User rec	IMBA
45	Chavez, D. J.	*Mountain Biking: Direct, Indirect and Bridge-Building Management Styles*	1996b	Journal of Park and Recreation Administration 14: 21-35				IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
46	Chavez, D. J.	*Mountain Biking Management: Resource Protection and Social Conflict*	1997	Trends, 34(3): 36-40		Hard copy provided by user	User rec	IMBA
47	Chavez, D.J., P.L. Winter, and J. M. Bass	*Recreational Mountain Biking: A Management Perspective*	1993	Journal of Park and Recreation Administration 11(3): 29-36				IMBA
48	Duncan, G., and S. Martin	*Comparing the Effectiveness of Interpretive and Sanction Messages for Influencing Wilderness Visitors' Intended Behavior*	2002	International Journal of Wilderness 8: 20-25		http://ijw.org/wp-content/uploads/2002/08/Vol-08.No-2.Aug-02small.pdf		
49	Goldstein, S. S.	*Mountain Bikes and the Parks: Mitigation of Safety and User Conflict Problems*	1987	Unpublished undergraduate paper	UC Santa Cruz	Hard copy provided by user	User rec	IMBA
50	Hendricks, W., R. H. Ramthun, and D. J. Chavez	*The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines*	2001	Journal of Park and Recreation Administration 19(3): 38-61	California Polytechnic State University, Concord College , USDA Forest Service		User rec	IMBA
51	Hoger, J. L. and D. J. Chavez	*Conflict and management tactics on the trail*	1998	Parks & Recreation, 33(9), 41-49.		http://admin.ibt.org.il/files/94644644798.pdf		
52	Hollenhorst, S. J., Schuett, M. A., Olson, D.	*Conflicts and Issues Related to Mountain Biking in the National Forests: A Multimethodological Approach*	1995	USDA Forest Service Gen. Tech. Rep. PSW-156.	USFS	http://www.fs.fed.us/psw/publications/documents/psw_gtr156/psw_gtr156_1_hollenhorst.pdf		IMBA
53	Jackson, S. A., Haider, W., & Elliot, T.	*Resolving inter-group conflict in winter recreation: Chilkoot Trail National Historic Site, British Columbia*	2004	Journal for Nature Conservation, 11(4): 317-323	University of Victoria	http://www.collectionscanada.gc.ca/obj/s4/f2/dsk3/ftp04/MQ61568.pdf		

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
54	Jacob, G. R. and R. Schreyer	*Conflict in Outdoor Recreation: A Theoretical Perspective*	1980	Journal of Leisure Research 4: 368-379	Utah State University			
55	Jellum, C. M.	*Managing Mountain Bike Recreation and User Conflicts: A Case Study on Mt. Baker-Snoqualmie National Forest, Washington State*	2007		Central Washington University	http://www.cwu.edu/~geograph/faculty/lillquist_files/pubs/Jellum_Thesis.pdf		
56	Koontz, C. R.	*Recreational Trail Conflict: Achieving Equity Through Diversity*	2005	Masters' Thesis, Master of Science in Recreation Management	University of Montana	Hard copy provided by user	User rec	
57	Lime, D. (editor)	*Congestion and Crowding in the National Park System: Guidelines for Management and Research*	1996	St. Paul: University of Minnesota Agriculture Experiment Station Publication 86-1996				
58	Lime, D., D. Anderson, and J. Thompson.	*Indentifying and Monitoring Indicators of Visitor Experience and Resource Quality: A Handbook for Recreation Resource Managers*	2004	St. Paul: University of Minnesota Department of Forest Resources	University of Minnesota	cpsp.cfans.umn.edu/publications/Indicators_Standards_Handbook.pdf		
59	Longsdorf, E. L.	*Mountain Bikes and Metropolitan Park Districts: Issues and Trends Indentified by State Parks and State Park Districts in Ohio*	2006	Proceedings of the 2006 Northeastern Recreation Research Symposium, GTR-NRS-P-14	American Trails	http://www.americantrails.org/resources/ManageMaintain/OhioMtnbike.html		
60	Manning, R. E	*Parks and Carrying Capacity: Commons Without Tragedy*	2007	Washington, DC: Island Press.				

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
61	Manning, R. E.	*Emerging Principles for Using Information/ Education in Wilderness Management*	2003	International Journal of Wilderness 9: 20-27, 12.		http://ijw.org/wp-content/uploads/2003/12/Vol-09.No-1.Apr-03small.pdf		
62	Moore, R. L., D. Scott and A. R. Graefe.	*The effect of activity differences on recreation experiences along a suburban greenway trail*	1998	Journal of Park and Recreation Administration 16(2), 35-53				
63	Morey, E. R., T. Buchanan and D. M. Waldman	*Estimating the benefits and costs to mountain bikers of changes in trail characteristics, access fees, and site closures: choice experiments and benefits transfer*	2002	Journal of Environmental Management (2002) 64, 411–422	University of Colorado, Boulder			
64	Morioka, Steven in Sloan, D. and T. Fletcher, Ed	*Off the Road: The Issues Surrounding Mountain Bicycling* in *Environmental Management for the East Bay*	1989	Report of the Environmental Sciences Senior Seminar	U. C. Berkeley		User rec	IMBA
65	Owens, P. L.	*Conflict as a Social Interaction Process in Environment and Behavior Research: The Example of Leisure and Recreation Research*	1985	Journal of Environmental Psychology 5: 243-259	University of Sheffield			
66	Pearce, B.	*Mountain Biking on the Niagara Escarpment*	1990	University of Waterloo Faculty of Environmental Studies, School of Urban and Regional Planning			User rec	IMBA
67	Schuett, M. A.	*State Park Directors' Perceptions of Mountain Biking*	1997	Environmental Management 21(2): 239-246				IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
68	Watson, A. E.	*Goal Interference and Social Value Differences: Understanding Wilderness Conflicts and Implications for Managing Social Density*	2001	USDA Forest Service Proceedings RMRSP-20: 62-67.	Forest Service			
69	Watson, A. E., M. J. Niccolucci and D. R. Williams	*The nature of conflict between hikers and recreational stock users in the John Muir Wilderness.*	1994	Journal of Leisure Research (26): 372-385	Forest Service			
70	Watson, A.E., C. Asp, J. Walsh, and A. Kulla	*The Contribution of Research to Managing Conflict Among National Forest Users*	1997	Trends 34(3): 29-35		http://www.fs.fed.us/psw/programs/recreation/publications.shtml		IMBA
71	Watson, A.E., D.R. Williams and J. J. Daigle	*Sources of Conflict Between Hikers and Mountain Bike Riders in the Rattlesnake NRA*	1991	Journal of Park and Recreation Administration 9: 59-71			User rec	IMBA
User Organization								
72	California Equestrian Trails & Lands Coalition	*Safety Considerations for Multi-use Trails*	2005	NOP Comment Letter O-5, p. 82	California Equestrian Trails & Lands Coalition	http://www.calequestriancoalition.com/FinalVerCETLCSafetyGuides.htm		
73	IMBA	*Trail Solutions: IMBA's Guide to Building Sweet Single-track*	2004	Boulder, CO: International Mountain Bicycling Association.	International Mountain Bike Association			
74	IMBA, Webber, P. Ed.	*Managing mountain biking: IMBA's guide to providing great riding*	2007	Boulder, CO: International Mountain Bicycling Association.	International Mountain Bike Association			

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Citation
75	Keller, K.D.	*Mountain Bikes on Public Land: A Manager's Guide to the State of the Practice*	1990	Washington DC: Bicycle Federation of America.	Bicycle Federation of America	Hard copy provided by user	User rec	IMBA
76	Backcountry Horsemen of California	*A Common Sense Guide for High Country Manners*	2008		Backcountry Horsemen of California	http://www.bchcalifornia.org/		
77	Bicycle Trails Council of Marin, Access4Bikes	Share the Trail Campaign	No Date		Share the Trail	www.Sharethetrail.org		
78	Brown, L.	*Impact of Mountain Biking – Palos Verdes Nature Preserve*	No Date	NOP Comment Letter O-5, p. 30				
Individual User								
79	Ford, R.	*Mountain Bike Survey Update*	1989	Unpublished Report, Santa Barbara Ranger District, Los Padres National Forest	USFS	Hard copy provided by user	User rec	IMBA
80	Lucke, J.	*Access to our Public Lands: Mountain Bikes, the Concept of Public Ownership, and the Fatal Flaw in Bicycle Trails Council of Marin v. Babbit*	No Date	No publishing information.		Hard copy provided by user	User rec	IMBA

ID	Author	*Title*	Year	Problem Definition					Design					Management					Outreach					Critique				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
	Federal																											
1	AASHTO	*Guide for the Development of Bicycle Facilities*	1999						X															●	◑	●	◑	○
2	Bowker, J. M., and D. B. English	*Mountain Biking at Tsali: An Assessment of Users, Preferences, Conflicts, and Management Alternatives*	2002				X																	●	◑	●	◑	○
3	Chavez, D. J.	*Mountain Biking: Issues and Actions for USDA Forest Service Managers*	1996a			X									X	X				X	X	X	X	●	●	●	◑	◑
4	FHWA	*Evaluation of Safety, Design and Operation of Shared Use Paths: Final Report*	2006																					●	●	◑	◑	○
5	FHWA	*BIKESAFE Website*	No Date		X									X										◑	◑	◑	◑	○
6	Hendricks, Ramthum and Chavez	*Mountain Bicyclists' Behavior in Social Trail Etiquette Situations*	2000	X																				●	◑	●	●	○

				Problem Definition					Design					Management					Outreach					Critique				
ID	**Author**	***Title***	**Year**	General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
7	Hessel-barth, W., B. Vachow-ski, M. Davies	*Trail Construction and Maintenance Notebook*	2007						x					x										●	◑	◑	◑	◑
8	Hollenhorst, S. J., Schuett, M. A., Olson, D. &Chavez, D.	*An Examination of the Characteristics, Preferences, and Attitudes of Mountain Bike Users of the National Forests*	1993				x													x				●	◑	◑	○	○
9	Kulla, A.	*A New Perspectives Approach in National Forest Recreation and its Application to Mountain Bike Management*	1991											x	x				x	x		x		◑	●	●	◑	○
10	Moore, R. L.	*Conflicts On Multiple-Use Trails: Synthesis of the Literature and State of the Practice*	1994		x									x					x	x	x	x	x	●	●	●	●	◑

ID	Author	*Title*	Year	Problem Definition					Design					Management					Outreach					Critique				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
11	National Park Service, Department of the Interior	*Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona*	2003					x																●	●	●	●	◑
12	Rouphail, N. J. Hummer, J. Milazzo II, P. Allen.	*Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedure*	1998	x																				●	●	◑	◑	○
13	Sprinkle Consulting	*Characteristics of Emerging Road and Trail Users and Their Safety.*	2004						x															●	◑	◑	◑	○
14	Tuler, S., Golding, D., Krueger, R.J.	*A Review of the Literature for a Comprehensive Study of Visitor Safety in the National Park System*	2002		x																			●	●	◑	◑	○
15	USDA Forest Service	*Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds*	2007	x					x	x														●	●	●	●	◑

ID	Author	*Title*	Year	Problem Definition					Design					Management					Outreach					Critique				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
	General																											
16	Birkny, R. C.	*Lightly on the Land: The SCA Trail-Building and Maintenance Manual*	1996						X	X														◑	●	◑	○	◑
17	Flink, C. A., and R. M. Searns	*Greenways: A Guide to Planning, Design and Development*	1993	X					X					X	X									◑	●	●	●	●
18	Flink, C., Olka, K., Searns, R., Rails-to-Trails Conservancy	*Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails*	1993	X					X	X					X	X			X					●	●	◑	◑	◑
19	MN Dept of Natural Resources	*Trail Planning, Design, and Development Guidelines*	2006	X					X		X			X										●	●	●	●	●
20	North Carolina DPR	*Results of the Two Year Mountain Bicycle Trail Study*	1993					X	X					X										●	●	◑	◑	●

ID	Author	*Title*	Year	Problem Definition					Design					Management					Outreach					Critique				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
21	Parker, T. S.	*Natural Surface Trails by Design: Physical and Human Design Essentials of Sustainable, Enjoyable Trails*	2004																					◑	◑	◑	○	●
	State																											
22	Bondurant, J., L.Thompson et. al.	*Trail Planning for California Communities*	2009	x					x	x	x			x										●	●	●	◑	◑
23	CA State Parks	*California State Parks Accessibility Guidelines*	2005						x		x													●	◑	◑	◑	○
24	Caltrans	*Highway Design Manual Chapter 1000: Bikeway Planning and Design*	2009						x															●	◑	◑	◑	○
25	Caltrans	*Manual on Uniform Traffic Control Devices*	2011											x										●	◑	●	●	○

ID	Author	*Title*	Year	Problem Definition					Design					Management					Outreach					Critique				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
	Local																											
26	Anderson, D.H., Lime, D. W., and T.L. Wang	*Maintaining the Quality of Park Resources and Visitor Experiences*	1998		x									x	x	x			x					●	●	●	●	●
27	Bauer, M.	*Recreation Conflict at Six Boulder County Parks and Open Space Properties: a Baseline Study*	2004				x																	●	◑	●	◑	○
28	Chiu, Luke and L. Kriwoken	*Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia*	2003				x			x		x		x					x					◑	◑	●	◑	○
29	City of Portland Parks & Recreation	*Trail Design Guidelines for Portland's Park System*	2009						x	x	x													●	●	●	●	●
30	City of San Jose	*Council Agenda 03-29-11: Trail Safety Enhancements*	2011					x						x										◑	●	○	○	○

ID	Author	*Title*	Year	**Problem Definition**: General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	**Design**: Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	**Management**: User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	**Outreach**: Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	**Critique**: Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
31	City of San Jose Trail Program	*Trail Signage Guidelines*	2010											X										●	●	◑	◑	○
32	City of St. Louis Board of Public Service	*Forest Park - Access, Circulation, and Parking Study*	2008				X																	●	◑	◑	◑	○
33	City of Vancouver, B.C. General Manager of Engineering Services	*Speed Limits on Recreational Bicycle Paths*	1995											X										●	◑	◑	◑	○
34	East Bay Regional Parks District (EBPRD)	*Narrow Natural Surface Trails Managing Multiple Use*	2011	X					X				X	X	X				X	X			X	●	◑	●	●	◑

ID	Author	Title	Year	Problem Definition: General	Problem Definition: Theoretical	Problem Definition: Manager Survey	Problem Definition: User Survey	Problem Definition: Incident/Complaint Data	Design: Width/Passing Areas	Design: Sight Distance	Design: Gradient	Design: Speed Control Features	Design: Curvilinear Design	Management: User Information	Management: Enforcement	Management: Rules & Regulations	Management: Public Notification	Management: Data Collection	Outreach: Education	Outreach: User Group Meetings	Outreach: Volunteer Programs	Outreach: User Group Notification	Outreach: Events	Critique: Objectivity	Critique: Thoroughness	Critique: Applicability	Critique: Useful Info	Critique: Sustainability
35	Midpeninsula Regional Open Space District	*Trail Use Guidelines and Mitigation Measures*	1993						x	x	x													●	●	●	●	○
36	Mosedale, J.	*Mountain Biking in the Canadian Rocky Mountains: A situational analysis*	2002			x	x							x					x	x	x			◑	○	◑	◑	○
37	Santa Clara County	*Adoption of Negative Declaration and Policy Related to New Off Road Bicycle Trail in County Parks*	1989				x							x	x	x			x		x			●	●	◑	◑	●
38	Searns, R., B. Woodcock & J. Pflaum	*Trail Maintenance and Management: We Built It and They Came*	2007									x				x								◑	○	◑	◑	○

ID	Author	*Title*	Year	Problem Definition: General	Problem Definition: Theoretical	Problem Definition: Manager Survey	Problem Definition: User Survey	Problem Definition: Incident/Complaint Data	Design: Width/Passing Areas	Design: Sight Distance	Design: Gradient	Design: Speed Control Features	Design: Curvilinear Design	Management: User Information	Management: Enforcement	Management: Rules & Regulations	Management: Public Notification	Management: Data Collection	Outreach: Education	Outreach: User Group Meetings	Outreach: Volunteer Programs	Outreach: User Group Notification	Outreach: Events	Critique: Objectivity	Critique: Thoroughness	Critique: Applicability	Critique: Useful Info	Critique: Sustainability
39	Santa Monica Mountains National Recreation Area	*Santa Monica Mountains Area Recreational Trail Coordination Project*	1997			x			x	x	x			x	x	x				x				●	●	●	●	◑
	Academic																											
40	Bradsher, D.J.	*The Relationship Between Past Experience and Multiple Use Trail Conflict*	2003				x													x	x			●	●	◑	◑	○
41	Carothers, P., J. Vaske, & M. P. Donnelly	*Social values versus interpersonal conflict among hikers and mountain bikers*	2001				x							x										●	●	●	◑	○
42	Cessford, G.R.	*Off-Road Impacts of Mountain Bikes: A Review and Discussion*	1995b				x					x												◑	◑	◑	◑	◑

ID	Author	*Title*	Year	**Problem Definition**					**Design**					**Management**					**Outreach**					**Critique**				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
44	Cessford, G.R.	*Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand*	2002				x																	◑	●	◑	◑	○
45	Chavez, D. J.	*Mountain Biking: Direct, Indirect and Bridge-Building Management Styles*	1996b			x													x	x				●	◑	●	◑	○
46	Chavez, D. J.	*Mountain Biking Management: Resource Protection and Social Conflict*	1997			x																		●	●	◑	◑	●
47	Chavez, D.J., P.L. Winter, and J. M. Bass	*Recreational Mountain Biking: A Management Perspective*	1993			x																		◑	◑	●	◑	◑
48	Duncan, G., and S. Martin	*Comparing the Effectiveness of Interpretive and Sanction Messages for Influencing Wilderness Visitors' Intended Behavior*	2002											x										◑	◑	◑	◑	○

				Problem Definition					Design					Management					Outreach					Critique				
ID	**Author**	***Title***	**Year**	General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
49	Goldstein, S. S.	*Mountain Bikes and the Parks: Mitigation of Safety and User Conflict Problems*	1987		X					X		X			X				X	X	X		X	◑	◑	◑	●	○
50	Hendricks, W., R. H. Ramthun, and D. J. Chavez	*The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines*	2001				X							X					X		X			●	●	●	●	○
51	Hoger, J. L. and D. J. Chavez	*Conflict and management tactics on the trail*	1998		X									X					X					●	◑	●	○	◑
52	Hollenhorst, S. J., Schuett, M. A., Olson, D.	*Conflicts and Issues Related to Mountain Biking in the National Forests: A Multimethodological Approach*	1995				X																	●	◑	●	◑	○
53	Jackson, S. A., Haider, W., & Elliot, T.	*Resolving inter-group conflict in winter recreation: Chilkoot Trail National Historic Site, British Columbia*	2004				X																	●	◑	◑	●	○

				Problem Definition					**Design**					**Management**					**Outreach**					**Critique**				
ID	**Author**	***Title***	**Year**	General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
54	Jacob, G. R. and R. Schreyer	*Conflict in Outdoor Recreation: A Theoretical Perspective*	1980		x																			●	◑	◑	◑	○
55	Jellum, C. M.	*Managing Mountain Bike Recreation and User Conflicts: A Case Study on Mt. Baker-Snoqualmie National Forest, Washington State*	2007				x		x		x	x		x					x	x				●	●	●	●	○
56	Koontz, C. R.	*Recreational Trail Conflict: Achieving Equity Through Diversity*	2005		x												x			x		x		◑	◑	◑	◑	○
57	Lime, D. (editor)	*Congestion and Crowding in the National Park System: Guidelines for Management and Research.*	1996		x		x									x			x					◑	◑	◑	◑	○
58	Lime, D., D. Anderson, and J. Thompson.	*Indentifying and Monitoring Indicators of Visitor Experience and Resource Quality: A Handbook for Recreation Resource Managers*	2004		x																			●	◑	●	◑	○

				Problem Definition					Design					Management					Outreach					Critique				
ID	**Author**	***Title***	**Year**	General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
59	Longsdorf, E. L.	*Mountain Bikes and Metropolitan Park Districts: Issues and Trends Indentified by State Parks and State Park Districts in Ohio*	2006			x																		◑	◑	●	◑	○
60	Manning, R. E	*Parks and Carrying Capacity: Commons Without Tragedy*	2007											x										●	◑	◑	◑	○
61	Manning, R. E.	*Emerging Principles for Using Information/Education in Wilderness Management*	2003				x							x						x				●	●	●	◑	○
62	Moore, R. L., D. Scott and A. R. Graefe.	*The effect of activity differences on recreation experiences along a suburban greenway trail*	1998				x																	●	◑	◑	○	○
63	Morey, E. R., T. Buchanan and D. M. Waldman	*Estimating the benefits and costs to mountain bikers of changes in trail characteristics, access fees, and site closures: choice experiments and benefits transfer*	2002				x																	◑	◑	●	◑	○

ID	Author	*Title*	Year	**Problem Definition** General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	**Design** Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	**Management** User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	**Outreach** Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	**Critique** Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
64	Morioka, Steven in Sloan, D. and T. Fletcher, Ed	*Off the Road: The Issues Surrounding Mountain Bicycling in Environmental Management for the East Bay*	1989					X																○	◑	◑	○	●
65	Owens, P. L.	*Conflict as a Social Interaction Process in Environment and Behavior Research: The Example of Leisure and Recreation Research*	1985		X																			●	●	◑	◑	○
66	Pearce, B.	*Mountain Biking on the Niagara Escarpment*	1990			X																		◑	◑	◑	○	●
67	Schuett, M. A.	*State Park Directors' Perceptions of Mountain Biking*	1997			X											X			X		X		◑	◑	◑	◑	○
68	Watson, A. E.	*Goal Interference and Social Value Differences: Understanding Wilderness Conflicts and Implications for Managing Social Density*	2001		X																			◑	◑	◑	○	
69	Watson, A. E., M. J. Niccoluc	*The nature of conflict between hikers and recreational stock users in*	1994		X																			●	●	●	◑	○

ID	Author	*Title*	Year	Problem Definition					Design					Management					Outreach					Critique				
				General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
	ci and D. R. Williams	*the John Muir Wilderness.*																										
70	Watson, A.E., C. Asp, J. Walsh, and A. Kulla	*The Contribution of Research to Managing Conflict Among National Forest Users*	1997				X								X			X	X	X				●	◑	●	◑	○
71	Watson, A.E., D.R. Williams and J. J. Daigle	*Sources of Conflict Between Hikers and Mountain Bike Riders in the Rattlesnake NRA*	1991				X							X					X					●	●	◑	◑	○
	User Organizations																											
72	California Equestrian Trails & Lands Coalition	*Safety Considerations for Multi-use Trails*	2005	X					X					X	X				X					◑	◑	●	●	◑
73	IMBA	*Trail Solutions: IMBA's Guide to Building Sweet Single-track*	2004	X								X	X	X										◑	◑	●	●	◑
74	IMBA, Webber,	*Managing mountain biking: IMBA's guide to*	2007	X					X		X	X	X	X	X	X	X		X	X	X	X		◑	◑	●	●	◑

ID	Author	Title	Year	Problem Definition: General	Theoretical	Manager Survey	User Survey	Incident/Complaint Data	Design: Width/Passing Areas	Sight Distance	Gradient	Speed Control Features	Curvilinear Design	Management: User Information	Enforcement	Rules & Regulations	Public Notification	Data Collection	Outreach: Education	User Group Meetings	Volunteer Programs	User Group Notification	Events	Critique: Objectivity	Thoroughness	Applicability	Useful Info	Sustainability
	P. Ed.	*providing great riding*																										
75	Keller, K.D.	*Mountain Bikes on Public Land: A Manager's Guide to the State of the Practice*	1990		x			x							x	x	x		x	x	x	x	x	●	◑	●	◑	●
76	Backcountry Horsemen of California	*A Common Sense Guide for High Country Manners*	2008																x					◑	◑	◑	○	○
77	Bicycle Trails Council of Marin, Access4Bikes	Share the Trail Campaign	No Date																x					○	○	●	◑	○
78	Brown, L.	*Impact of Mountain Biking –Palos Verdes Nature Preserve*	No Date	x																				○	◑	○	○	◑
	Individual User																											
79	Ford, R.	*Mountain Bike Survey Update*	1989				x																	●	●	◑	◑	○
80	Lucke, J.	*Access to our Public Lands: Mountain Bikes,*	No Date	x																				○	○	◑	◑	◑

ID	Author	*Title*	Year	Problem Definition: General	Problem Definition: Theoretical	Problem Definition: Manager Survey	Problem Definition: User Survey	Problem Definition: Incident/Complaint Data	Design: Width/Passing Areas	Design: Sight Distance	Design: Gradient	Design: Speed Control Features	Design: Curvilinear Design	Management: User Information	Management: Enforcement	Management: Rules & Regulations	Management: Public Notification	Management: Data Collection	Outreach: Education	Outreach: User Group Meetings	Outreach: Volunteer Programs	Outreach: User Group Notification	Outreach: Events	Critique: Objectivity	Critique: Thoroughness	Critique: Applicability	Critique: Useful Info	Critique: Sustainability
		the Concept of Public Ownership, and the Fatal Flaw in Bicycle Trails Council of Marin v. Babbit																										

Table E-2. Documents Reviewed Not Pertaining to Trail User Conflicts

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
Federal									
1	Chavez, D. J.	*Visitor Perceptions of Crowding and Discrimination at Two National Forests in Southern California*	1993	Res. Paper PSW-RP-216. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.	US Forest Service, Utah State University	http://www.fs.fed.us/psw/publications/documents/psw_rp216/psw_rp216.pdf		Discusses visitor perceptions of crowding and discrimination to determine the potential of visitor displacement from recreational sites in two National Forests in 1990.	IMBA
2	FHWA	*US Department of Transportation FHWA Recreational Trails Program*	1998		FHWA	http://www.fhwa.dot.gov/environment/rectrails/publications.htm		Aggregation of other sources; relevant ones included individually.	
3	Marion, J. L.	*Assessing and Understanding Trail Degradation: Results from Big South Fork National River and Recreational Area*	2006	NPS. USGS Patuxent Wildlife Research Center, Cooperative Park Studies Unit, Virginia Tech Dept. of Forestry			User rec	Environmental	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
4	Trails and Wildlife Task Force, Colorado State Parks, Hellmund Associates	*Planning Trails with Wildlife in Mind: A Handbook for Trail Planners*	1998			http://www.fs.fed.us/outdoors/naturewatch/start/planning/Trails-for-Wildlife-Handbk.pdf		Environmental; does not relate to user conflicts	
General									
5	Fruin, J.J.	*Pedestrian Planning and Design*	1971	New York, NY, 1971. 25	Metropolitan Association of Urban Designers and Environmental Planners			Discusses urban pedestrian characteristics	
State									
6	CA State Parks	*California Recreational Trails Plan Phase I*	2002		CA State Parks	http://www.parks.ca.gov/pages/1324/files/ca%20rec%20trails%20plan.pdf		Goals and policies; does not relate to user conflicts	
7	CA State Parks	*Best Management Practices For Road Rehabilitation: Road to Trail Conversion*	2003		CA State Parks	http://www.parks.ca.gov/pages/23071/files/road%20to%20trail.pdf		Technical reference	

ID	Author	Title	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
8	CA State Parks	*Trail Manager's Toolbox*			CA State Parks	http://www.parks.ca.gov/?page_id=23419#multi-use%20trail%20management		Aggregation of other sources; relevant ones included	
9	California Public Resources Code	*Section 5850(e)*				http://law.onecle.com/california/public-resources/5850.html	User rec	Does not provide background on the problem or strategies	
Local									
10	Center for Changing Landcapes and the Department of Forests	*Minnesota's Network of Parks & Trails*	2011		College of Food, Agricultural, and Natural Resource Sciences and College of Design at the University of Minnesota	http://ccl.design.umn.edu/documents/MNPaTFrameworkJanuary2011_001.pdf	User rec	Document refers to general need to address conflict; no relevant data.	
11	Crockett, Christopher S	*Survey of Ecological Impact Considerations Related to Mountain Bicycle Use on the Edwards Field Trail at Joseph D. Grant County Park*	1986		Santa Clara County (CA) Parks Dept.			Environmental	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
Academic									
12	Alder, J.	*Costs and Effectiveness of Education and Enforcement, Cairns Section of the Great Barrier Reef Marine Park*	1996	Environmental Management 20: 541-51				Evaluation of efficacy of educating users about a marine park conservation zone, attitudes towards management; not directly related.	
13	Bacon, J., R. Manning, D. Johnson, and M. Vande Kamp	*Norm Stability: A Longitudinal Analysis of Crowding and Related Norms in the Wilderness of Denali National Park and Preserve*	2001	The George Wright Forum 18(3): 62-71		http://www.georgewright.org/backlist_forum.html		This study compares the results of a 1978 and a 2000 user survey evaluating perceptions of crowding; not directly relevant.	
14	Botma, H.	*Method to Determine level of service for bicycle paths and pedestrian-bicycle paths*	1995	Transportation Research Record 1502: 38-44	Transportation Research Board			Pertains to paved paths	

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
15	Botma, H., and H. Papendrecht	*Traffic Operations of Bicycle Traffic*	1991	Transportation Research Record 1320, Washington, DC, pp. 65–72, 1991.	Transportation Research Board			Pertains to paved paths	
16	Brown, L.	*Griffith Park provides equestrian trails in the heart of the city*	2007	American Trails Magazine	Equestrian Trails, Inc	http://www.americantrails.org/trailtracks/07spring/griffithhorse.html	User rec	Environmental	
17	Cessford, G.R.	*Off Road Mountain Biking: A Profile of Participants and their Recreation Setting and Experience Preferences*	1995a	Science and Research Series no. 93	Science and Research Division, Department of Conservation		User rec	Discusses the experiential desires of mountain bikers; does not address conflicts.	IMBA
18	Cole, David N.	*Visitor and Recreation Impact Monitoring: Is it Lost in the Gulf Between Science and Monitoring?*	2006	The George Wright Forum 23.2 (2006): 11-16	Aldo Leopold Wilderness Research Institute	http://leopold.wilderness.net/pubs/581.pdf		Discusses the need for additional data; not related to user conflicts.	

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
19	Gander, H. and P. Ingold	*Reactions of Male Alpine Chamois Rupicapra r.rupicapra to Hikers, Joggers and Mountain Bikers*	1996	Biological Conservation 79:107 - 109.				Environmental	IMBA
20	Goeft, Ute and Alder, Jackie	*Sustainable Mountain Biking: A Case Study from the Southwest of Western Australia*	2001	Journal of Sustainable Tourism 9(3): 193 - 211.				Environmental	IMBA
21	Hendricks, W.	*Mountain Bike Management and Research: An Introduction*	1997	Trends 34(3): 2-4		Hard copy provided by user	User rec	Introduction to the Trends magazine issue that addresses conflicts on trails; individual articles included separately.	
22	Homburger, W.S.	*Capacity of Bus Routes, and of Pedestrian and Bicycle Facilities.*	1976	Institute of Transportation Studies, University of California, Berkeley.				On-street facilities	

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
23	Landis, B.W., V.R. Vattikuti, and M.T. Brannick	*Real-Time Human Perceptions: Toward a Bicycle Level of Service*	1997	Transportation Research Record 1578, Washington, DC, 1997.				Paved trails	
24	Lawson, S., and R. Manning	*Crossing Experiential Boundaries: Visitor Preferences Regarding Tradeoffs Among Social, Resource and Managerial Attributes of the Denali Wilderness*	2001	The George Wright Forum 18(3): 10-27		http://www.georgewright.org/183lawson.pdf		Document focuses on management of backcountry hiking; not other uses	
25	Papouchis, C. M., F. J. Singer and S. William	*Responses of Desert Bighorn Sheep To Increased Human Recreation*	2001	Journal of Wildlife Management 65(3): 573 - 582.				Environmental	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
26	Reynolds, C., M. Harris, K. Teschke, P. Cription, and M. Winters.	*The Impact of Transportation Infrastructure on Bicycling Injuries and Crashes: A Review of the Literature*	2009	Environmental Health Journal 8.47 (2009).	University of British Columbia	http://www.ehjournal.net/content/pdf/1476-069x-8-47.pdf		Pertains to paved paths and automobile traffic safety	
27	Rodgers, G.B.	*Factors Associated with the Crash Risk of Adult Bicyclists*	1997	Journal of Safety Research 28: 233-241.				Compares relative risk of types of bicycle facilities; not related to other users	
28	Rothman	*The War for the Future: Mountain Bikes and the Golden Gate Recreation Area*	2001	The George Wright Forum 18(1)		Hard copy provided by user	User rec	Describes the history of mountain bike access issues in the San Francisco area.	IMBA
29	Schneider, I. E.	*Revisiting and revising recreation conflict research*	2000	Journal of Leisure Research 32(1): 129-132.				General conceptual argument for conflicts; not directly related	

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
30	Spahr, R.	*Factors Affecting The Distribution Of Bald Eagles And Effects Of Human Activity On Bald Eagles Wintering Along The Boise River*	1990		Boise State University			Environmental	IMBA
31	Symmonds, M. C., W.E. Hammit and V. L. Quisenberry	*Managing Recreational Trail Environments for Mountain Bike User Preferences*	2000	Environmental Management 25(5): 549-571				Identifies social characteristics and experiential needs of mountain bikers to accommodate their needs.	IMBA
32	Taylor, A. R. and R. L. Knight	*Wildlife Responses to Recreation and Associated Visitor Perceptions*	2003	Ecological Applications 13(4): 951 - 963.				Environmental	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
33	Thurston, E. and R. J. Reader	*Impacts of Experimentally Applied Mountain Biking and Hiking on Vegetation and Soil of a Deciduous Forest*	2001	Environmental Management 27(3): 397 - 409.				Environmental	IMBA
34	Tinsworth, D., S. Cassidy, C. Polen	*Bicycle-related injuries: Injury, hazard, and risk patterns*	1994	International Journal of Injury Control and Safety Promotion, 1(4):207-220				Pertains to paved paths and automobile traffic safety	
35	Vaske, J. J., M. P. Donnelly et al.	*Establishing Management Standards: Selected Examples of the Normative Approach*	1993	Environmental Management 17(5): 629-643				Establishes experiential standards to be used in qualitative evaluations of visitor park experiences; does not address conflicts.	IMBA
36	Weir, D.	*A Guide to the Impacts of Non Motorized Trail Use*	2000	Don Weir and Associates- Edmonton Alberta Canada		Hard copy provided by user	User rec	Environmental; user conflicts cite Jacob and Schreyer (1980), Moore (1996) and Kulla (1991).	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
37	Wilson, J. P. and J. Seney	*Erosional Impacts of Hikers, Horses, Motorcycles and Off-Road Bicycles on Mountain Trails in Montana*	1994	Mountain Research and Development 14(1): 77 - 88.					IMBA
User Organization									
38	Concerned Off Road Bicyclists Association	*Rules of the Trail*	No Date	Concerned Off Road Bicyclists Association		http://www.corbamtb.com/Resources/RulesoftheTrail.shtml			
39	Dice, Jenn	*Saguaro*	2003	AmericanTrails.org	International Mountain Bike Association	http://www.americantrails.org/resources/ManageMaintain/CactusTrailBike.html		Environmental	IMBA
40	Lanza, M.	*Trail Shock*	2001	Appalachian Mountain Club Outdoors Magazine.		Hard copy provided by user	User rec	Environmental	IMBA
41	Marion, J. and J. Wimpey	*Environmental Impacts of Mountain Biking: Science Review and Best Practices*	2007	International Mountain Bike Association		http://www.imba.com/resources/research/trail-science/environmental-impacts-mountain-biking-science-review-and-best-practices		Environmental	IMBA

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
42	Sprung, G.	*Natural Resource Impacts of Mountain Biking: A summary of scientific studies that compare mountain biking to other forms of trail travel*	2007	International Mountain Bike Association		http://www.imba.com/		Environmental	
43	Action Coalition of Equestrians, et. al.	*Motion to Intervene, Comments & Protest*	2006	NOP Comment Letter O-5 p. 88; Docket No. P-2100, P-2100-052. March 31, 2006	Federal Regulatory Commission	Hard copy provided by user	User rec	Motion to reconsider allowing mountain bikes on a trail in Oroville, CA. Contains user arguments and criticisms of the incomplete analysis; no data or analysis.	

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
44	Action Coalition of Equestrians, et. al.	*Motion to Intervene, Comments, & Protest Re: Project 2100-119 Oroville (Feather River Dam) – California Department of Water Resources' Application for Amendment of License*	2003		Mountain Bike Task Force for the City of Los Angeles	Hard copy provided by user	User rec	Discusses mountain bikers' goals and environmental impact; includes letters of support. No information on user conflict or specific strateies.	
45	Park Watch	*Park Watch Reports for Folsom Lake Pioneer Express Trail*	2010	NOP Comment Letter O-5, p. 65; Park Watch.org		Hard copy provided by user	User rec	Incident reports collected by user group - may be incomplete, no recommendations	
46	Ride with Respect	*Trail Sharing: from concept to application*	No Date			Hard copy provided by user	User rec	Presentation of sharing the trail; cites several documents included.	
47	Johnson, J.	*Trail wars at Annadel State Park*	2010	NOP Comment Letter O-5, p. 61; The Press Democrat, July 6 2010		Hard copy provided by user		Discusses impacts of illegal trails.	

ID	Author	*Title*	Year	Journal/Citation	Agency/ Affiliation	Link	Source	Notes	Citations
Individual User									
48	Vandeman, Mike	*The Impacts of Mountain Biking on Wildlife and People - A Review of the Literature*	2004			http://home.pacbell.net/mjvande/scb7	User rec	Environmental	
49	Vandeman, Mike	*A Critique of "A Comparative Study of Impacts to Mountain Bike Trails in Five Common Ecological Regions of the Southwestern U.S." (White et al 2006)*	2006			http://home.pacbell.net/mjvande/white	User rec	Environmental	
50	Vandeman, Mike	*Letter to author of the paper, "Assessing and Understanding Trail Degradation: Results from Big South Fork National River and Recreation Area"*	No Date			http://home.pacbell.net/mjvande/marion	User rec	Environmental	

Table E-3. Documents Not Found

ID	Author	Title	Year	Journal/Citation	Agency/ Affiliation	Citation
	Federal					
1	Doucette, J. E., and D. N. Cole.	*Wilderness visitor education: Information about alternative techniques*	1993	General Technical Report INT-295. Ogden, UT: USDA Forest Service, Intermountain Research Station.	US Forest Service	
	Academic					
2	Horn, C.	*Conflict in Recreation: the Case of Mountain-Bikers and Trampers*	1994	Unpublished masters' thesis, Department of Parks, Recreation and Tourism, Lincoln University		IMBA
	State					
3	Colorado State Parks	*Trails and Wildlife Bibliography*	1997	Colorado State Parks, Trails Program	Colorado State Parks Trails Program	User recommendation
	Local					
4	Bjorkman, A.	*Off Road Bicycle and Hiking Trail User Interactions: A Report to the Wisconsin Natural Resources Board*	1996		Wisconsin Bureau of Natural Resources: Bureau of Research	IMBA
5	Pettit, B., and P. Pointes	*"Kepner-Trego analysis": Mountain bicycle situation on Santa Barbara front trails managed by the U.S. Forest Service*	1987	Unpublished report, Santa Barbara Ranger District, Los Padres National Forest	USFS	IMBA

ID	Author	Title	Year	Journal/Citation	Agency/ Affiliation	Citation
	Academic					
6	Devall, W. and Harry J.	*Who Hates Whom in the Great Outdoors: The Impact of Recreational Specialization on Technologies of Play.*	1981	Leisure Sciences 4(4): 399-418		IMBA
7	Grost, R.	*Managing the Mountain Bike*	1989	American Forests 95: 50-53, 75-77		IMBA
8	Hall, T. and B. Shelby	*Who Cares About Encounters? Differences Between Those With and Without Norms*	1996	Leisure Sciences 18: 7-22		
9	Hammit, W. E. and D. N. Cole	*Wildland Recreation: Ecology and Management*	1998	New York: John Wiley and Sons, Inc.		IMBA
10	Hendricks, W.	*A resurgence in recreation conflict research: Introduction to the special issue*	1995	Leisure Sciences 17(3):157-159		
11	Jacoby, J.	*Mountain Bikes: A New Dilemma for Wildland Recreation Managers?*	1990	Western Wildlands 16(1): 25-28		IMBA
12	Manning, Robert E	*Studies in Outdoor Recreation*	1999		Oregon State University	
13	Navin, F.P.D.	*Bicycle Traffic Flow Characteristics: Experimental Results and Comparisons.*	1994	ITE Journal, Vol. 64, No. 3, March 1994.		
14	Philley, M. and S. McCool	*Law Enforcement in the National Park System: Perceptions and Practices*	1981	Leisure Sciences 4: 355-71		
15	Ramthum	*Factors in User Group Conflict Between Hikers and Mountain Bikers*	1995	Leisure Sciences 17(3): 159-170		IMBA
16	Schneider, I.E., and W.E. Hammitt	Visitor Response to Outdoor Recreation Conflict: A Conceptual Approach	1995	Leisure Sciences 17(3):223-234		
17	Vaske, Donnelly, Karin & Laidlaw	*Interpersonal versus social-values conflict*	1995	Leisure Sciences 17(3): 205-222		
18	Watson, A. E.	*An analysis of recent progress in recreation conflict research and perceptions of future challenges and opportunities*	1995	Leisure Sciences 17(3): 235-238		

E.1 Federal Guidelines and Studies

E.1.1 Guide for the Development of Bicycle Facilities

American Association of Highway Transportation Officials (AASHTO). 1999.

The Association of State Highway and Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities* provides national standard for bikeways. According to the AASHTO Guide, shared-use paths should be 12 to 14 feet wide, with 2-foot shoulders on either side. The minimum allowed for a two-way shared-use path is 10 feet, which is only recommended for low traffic situations. Clearance to overhead obstructions should be a minimum of 8 feet. The Guide does not provide assistance for selecting the appropriate width.

The Guide recommends a minimum design speed on a shared-use path of 20 mph, or 30 mph where a downgrade exceeds 4 percent or where strong prevailing tailwinds exist. The Guide recommends using design and traffic controls to control 'excessive speeds' over the 30 mph, but cautions that, "Lower design speeds should not be selected to artificially lower user speeds."

The manual also provides design guidance for maximum grade, sightlines, turning radii and intersections of off-street facilities based on desired speed of bicyclists. It does not discuss alternative actions for reducing speed on a facility. For shared facilities over structures (i.e. bridges), the Guide recommends that the minimum clear width should be the same as the approach paved shared-use path, in addition to the minimum 2-foot wide clear areas.

Keywords: Design guidelines, width, design speed

Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.1.2 Mountain Biking at Tsali: An Assessment of Users, Preferences, Conflicts, and Management Alternatives

Bowker, J. M., and D. B. English. 2002. U.S. Department of Agriculture Forest Service, Southern Research Station. General Technical Report SRS-59.

This study was written by social scientists at the Forest Service Southern Research Station in Athens, Georgia. The study was conducted at the Tsali Recreation Area, part of the Cheoah Ranger District of the Nantahala National Forest, near the Great Smoky Mountains. Other affiliates include the Nantahala Outdoor Center, Graham County, the Department of Agricultural and Applied Economics and the Department of Recreation and Leisure Studies at the University of Georgia, and the Forest Resources department at the Clemson University. The Recreation Area has a four-loop trail system just under 38 miles in length, and accommodates hikers, mountain bikers, and equestrians. Tsali is a fee demonstration site, and the park alternates between allowing mountain bikers and equestrians.

An on-site survey of visitors examined the demographics, behavior, current trip profile, and attitudes toward user fees, current management policies, and future management alternatives. The survey found that trail surface and congestion were the most important site attributes to visitors (43.9 percent and 40.0 percent, respectively), while horse/bike rotation was the third most important attribute (37.8 percent). The survey also found that the majority of users do not object to the idea of user fees. Most (89.4 percent) felt that the $2 per day or $15 per year fee was appropriate.

Respondents were also asked to report their feelings about a variety of scenarios of increased user fees for expanded amenities and trails. Most respondents desired changes involving moderate cost increases. The primary desired improvement was to increase trail miles. Most visitors (95 percent) agreed that fees are a "good tool to manage public recreation areas," in general and at Tsali. Visitors overwhelmingly supported future management alternatives that proposed more trail miles, even when these were combined with fee increases.

Keywords:	Problem definition (user survey), trail layout/availability				
Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.1.3 Mountain Biking: Issues and Actions for USDA Forest Service Managers

Chavez, D. J. 1996a. Res. Paper PSW-RP-226-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

This article was written by a research social scientist with the Pacific Southwest Research Station's Wildland Recreation and the Urban Culture Research Unit, based in Riverside, California. The study is a continuation of an early 1990s National Park Service study by Tilmant (unpublished) that examined mountain biking on a national scale. The International Mountain Bicycling Association (IMBA) cites this article on their website.

The article presents the results of a national survey of U.S. Forest Service (USFS) resource managers from 90 National Forests. The research objectives were to describe the amount of mountain bike riding in National Forests, to determine the level of planning currently used by Forest Service managers to deal with issues related to mountain bike use, and to examine management issues and actions related to mountain bike use in National Forests including resource damage, user conflicts, safety, and accidents.

The questionnaire results indicate that National Forest managers' primary concerns related to mountain biking include effects on natural resources (42 percent), conflicts with other user groups (34 percent), safety concerns (13 percent), illegal use in designated wilderness (13 percent), and the growth of the sport (12 percent). In addition, 70 percent of managers had received reports of user conflicts and 48 percent noted specific problems related to incidents. The most significant conflict issues reported were those between mountain bikers and equestrians (41 percent) and mountain bikers and hikers (31 percent). Twenty-one percent reported that the problems were due to the speed of mountain bikers, while 11 percent felt it was generally the other party's behavior.

Managers responded to an open-ended question about the methods they use to reduce user conflicts. The responses were grouped into the following categories:

- Information/education (63 percent) – Safety, brochures, posters, signs, IMBA triangle, etc.
- Cooperation (27 percent) – Personal interactions, volunteer patrols, partnerships, and providing mountain bike shops with rules and regulations.

- Visitor restrictions (17 percent) – Separate user groups, separate trails, alternating use between user groups, redirecting bike use to other trails, law enforcement, and denial of event permits.
- Resource hardening (7 percent) – Changing trail to meet needs, shorter loops for hikers, longer for mountain bikes, and upgrading trails.

The survey asked about safety problems (incidents) and accidents separately from user conflicts. Most managers had observed or reported safety problems (incidents) related to mountain bike use (59 percent), while almost half had observed or received reports of accidents involving mountain bikes (48 percent). Issues included excessive mountain biker speeds, concerns about pack animal groups, mountain bikes that were too quiet (they did not warn other users they were approaching), and mountain bikers being careless around vehicles. Responses to safety issues were categorized in the following ways:

- Information/Education (58 percent) – Safety rules, multiple uses, brochures, maps, trail descriptions, newspaper articles, club newsletters, signs with appropriate use, ethics, etiquette, and low impact use.
- Cooperation (17 percent) – Personal contacts, partnerships, and workshops.
- Visitor Restrictions (12 percent) – Separate trails, enforcement contacts, and non-issuance of special use permits.
- Resource hardening (8 percent) – Wider turnouts and rubber belting on water bars.

Managers also recommended additional research studies on the following: the value of bike patrols and partnerships for alleviating conflict or resource damage; trail construction that can alleviate trail damage; mountain biking interactions with the community; and an evaluation of whether displacement of trail users is an issue.

Chavez concludes that, "trail maintenance is a reasonable way to deal with safety and accident problems, and information and personal interaction are the most reasonable tools for dealing with conflict issues."

Keywords: Problem definition (manager survey), trail layout/availability, user group notification, volunteer programs, events, user group meetings, public notification, user information, alternate use days, rules & regulations, enforcement

Objectivity:	●	Applicability	●	Sustainability:	◑
Thoroughness	●	Useful Information	◑		

E.1.4 Evaluation of Safety, Design, and Operation of Shared-Use Paths

Hummer, J.E., Rouphail, J.L., Toole, J.L., Patten, R.S., Schneider, R.J., Green, J.S., Hughes, R.G., and Fain, S.J. 2006. FHWA-HRT-05-137 http://www.fhwa.dot.gov/publications/research/safety/pedbike/05137/

This 2006 study for FHWA analyzes operational data from 15 paved paths in 10 cities, as well as surveys from over 100 trail users. The evaluation provides a tool to evaluate the operational effectiveness of a shared-use path, given a traffic forecast or observation at an existing path along with some geometric parameters. The project team used a video camera mounted on a moving bicycle to collect data, as well as surveying users "to quantify the effect of selected operational trail parameters on bicyclist andpedestrian judgments of the perceived adequacy of the trail facility."

The study considers both passive passing, in which the test bicyclist is passed by a faster path user and delayed passing, when the test bicyclist would arrive behind a slower path user and not be able to pass because of the lack of an adequate-sized gap in the next lane to the left (oncoming or same direction).

The methodology involved gathers substantial data related to average speed, number of meetings, passing space, and other data about how bicyclists, pedestrians, inline skaters, runners, and child bicyclists interact. It includes a review of international literature about mode space needs, speeds, and operating characteristics. The analysis builds on the *Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedures* research for the 2000 HCM (see below), and provides a model of path LOS that incorporates the user types listed above.

The analysis is highly objective, although space requirements and other operational characteristics are taken from other studies and do not include user perceptions of conflicts or conflicting goals. Capacity analysis is useful for this analysis, particularly on paved shared-use pathways.

Keywords:	Design guidelines				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.1.5 BIKESAFE Bicycle Countermeasure Selection System Website

FHWA. No Date. www.bicyclinginfo.org/bikesafe/countermeasure.cfm?CM_NUM=34

The Federal Highway Administration (FHWA) operates the BIKESAFE website, which recommends countermeasures to alleviate a variety of bicycle-related issues and safety concerns. The website's 'Share the Path Treatments' page highlights the importance of good path design, policies, education, and enforcement. The website generally recommends involving various user groups in planning and share-the-path type programs, then provides specific guidance in the case study of Victoria, British Columbia.

Case Study #36 - Share the Trail: Minimizing User Conflicts on Non-Motorized Facilities

Todd Litman of the Victoria Transport Policy Institute contributed BIKESAFE Case Study #36 based on experience in Victoria, British Columbia. Litman argues that a reliance on separating user types can prohibit some forms of transport. He recommends focusing on users' behavior rather than mode and presents a generalized comparison of speed, size, and maneuverability of a variety of modes found on the Galloping Goose Regional Trail.

Litman recommends clarifying trail rules by publicizing them in signage, brochures, and through a website. He argues against imposing traffic citations on non-motorized vehicles due to perception and difficulty of processing a citation.

The website provides general recommendations for countermeasures that improve the bicycling environment, supporting the recommendations with case studies of jurisdictions that have dealt with the specific issues. In the case of trail user conflicts, Litman's analysis is more general than most case studies, and the recommendations are not directly supported by data or evaluation. However, recommendations related to etiquette signage are relevant to this study.

Keywords: Problem definition (theoretical), trail layout/availability, user information

Objectivity: ◑ Applicability ● Sustainability: ○

Thoroughness ◑ Useful Information ◑

E.1.6 Mountain Bicyclists' Behavior in Social Trail Etiquette Situations

Hendricks, Ramthum and Chavez. 2000. Proceedings of the 1999 Northeastern Recreation Research Symposium. Gen. Tech. Rep. NE-269. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 194-198.

William Hendricks is an Associate Professor of Recreation Administration at California Polytechnic State University. He has published previous papers pertaining to mountain biker behavior and management practices, including *Mountain Bike Management and Research: an Introduction* (1997) and *Mountain Bike Trail Etiquette: A Comparison of Guidelines and Behavior* (1995, with Ruddell). Roy Ramthum is an Assistant Professor of Travel Industry Management at Concord College. He has published previous papers on the study of trail etiquette such as *Analysis of the Role of Physical and Situational Factors in Trail Etiquette* (1992, with Ruddell). Deborah Chavez is a Research Social Scientist with the USDA forest service who has published several other articles included in this Literature Review, including *Recreational Mountain Biking: A Management Perspective* (1993, with Winter and Bass), *Mountain Biking: Issues and Actions for USDA Forest Service Managers* (1996), and *Mountain Biking: Direct, Indirect, and Bridge-building Management Styles* (1996). IMBA cites this article on their website.

This article analyzes data collected from the Mt. Tamalpais recreation area in Marin County, California with the purpose of gaining insight into the factors that affect etiquette behavior of mountain bikers when they encounter hikers on a trail. The study specifically looks at yielding behavior and traveling speed of mountain bikers as they approach hikers on a trail. The study surveyed 188 mountain bikers on random days at random times during the summer of 1998. The researches collected data on yielding behavior, approach speed, estimated age, gender, and equipment indicators (e.g. clipless pedals, hydration pack, gloves) for each biker who passed. The results showed that the majority of bikers yielded only slightly to the oncoming hikers and that 60 percent of mountain bikers surveyed were travelling over the recommended maximum safe speed (15 mph). They also showed that generally mountain bikers who were younger, male, and with more accessory equipment yield less to hikers and travel at unsafe speeds more frequently than other user groups.

As a result of the study, it is concluded that management issues persist in Tamalpais even after a 20-year history of simultaneous trail use by mountain bikers and hikers. These issues continue in spite of continued management practices such as informational signage on trail etiquette, informational publications on etiquette produced by local interest groups, and fines up to $200 for violating trail speed limits (checked by patrols equipped with radar guns). However, management techniques have not been as stringent in recent years as in the past, and this may have an effect on the tendency of younger users to yield to hikers less and speed more. The authors recommend reconsidering and reutilizing these management techniques to reduce the occurrence of poor trail etiquette by mountain bikers.

The study suggests that the majority of mountain bikers in Tamalpais are not exercising safe and courteous practices for shared-use trails. The authors suggest the greater utilization of direct and indirect management tools such as informational signage on trail etiquette, informational publications on etiquette produced by local interest groups, and fines for violating speed limits to help alleviate this problem. However, the effectiveness of these techniques in Tamalpais seems uncertain. A more effective solution may be better trail design and programming. Effective trail design solutions (e.g. trail width narrowing in limited visibility areas to slow riders) and programming solutions (e.g. one-way trails, alternating use trails, locating difficult/expert trails at greater distances from trailheads) in conjunction with the management tools mentioned by the authors may provide greater effectiveness in reducing trail user conflicts, although the authors did not study the effectiveness of these techniques.

Keywords:	Problem definition (general)				
Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	●		

E.1.7 Trail Construction and Maintenance Notebook

Hesselbarth, W., Vachowski, B., and M Davies. 2007. FHWA and United States Forest Service. http://www.fhwa.dot.gov/environment/fspubs/07232806/index.htm

This online resource is a handbook of Best Management Practices (BMPs) for physical trail construction and maintenance, particularly gravel and dirt trails. It was produced by the Forest Service in cooperation with the Recreational Trails Program (RTP), and several agencies report using it as a design resource in the Agency Survey.

The Trail Construction and Maintenance Notebook (Notebook) is based on the professional expertise and experience of the authors. A long list of contributors and reviewers indicates thorough oversight. The Notebook includes the following: guidance for drainage, erosion, grade, and alignment; tools and methods of trail construction; standards for decommissioning trails; and signs and wayfinding guidance.

The majority of the recommendations address drainage and other environmental concerns of trails, rather than addressing safety issues or conflicts between users. The Notebook recommends leaving tree stumps in order to minimize downhill trail creep, but it does not mention the possible speed control benefits.

Keywords:	Design guidelines, width/passing area, user information				
Objectivity:	●	Applicability	◑	Sustainability:	◑
Thoroughness	◑	Useful Information	◑		

E.1.8 An Examination of the Characteristics, Preferences, and Attitudes of Mountain Bike Users of the National Forests

Hollenhorst, S. J., Schuett, M. A., Olson, D. & Chavez, D. 1993. Journal of Park and Recreation Administration, 13(3): 41-51. Report #PSW-920019CA

This report was conducted by a professor (Hollenhorst) and a master's student (Olson) in the Division of Forestry at West Virginia University and a professor in the Department of Health, Physical Education, and Recreation at Southwest Texas State University (Schuett), in cooperation with Deborah Chavez, of the USFS Pacific Southwest Experiment Station. This information is also presented in the shorter summary, *Conflicts and Issues to Mountain Biking in the National Forests: A Multimethodological Approach* (Hollenhorst, Schuett, Olson, & Chavez, 1995). IMBA cites this article on their website.

The study's objectives are to describe the demographic characteristics of mountain bikers and patterns of participation (participation rates, opportunity preferences, and patterns). The authors collected on-site questionnaires from 750 mountain bikers from May to September 1992. Locations included Monogahela National Forest in West Virginia; the Cleveland, Inyo, and San Bernadino National Forests in California; and the Sam Houston and Davy Crockett National Forests in Texas. The authors also conducted focus group interviews.

The authors found that mountain bikers are concerned with conflict with other users but are generally tolerant of other users. Mountain bikers also generally felt that other users should "change their outlook and maintain a less 'possessive' attitude about the trails and become more understanding of increases in trail usage by mountain bikers." The authors also asked why participants mountain bike, why mountain biking has become popular in national forests, and to identify important issues and problems facing mountain biking in national forests. They categorized these open-ended questions and concluded that, "A cooperative effort between mountain bicyclists, other user groups and the land managing agencies appears to be the most effective approach thus far." However, it is unclear how this conclusion was derived from the open-ended opinion data collected from users.

Keywords:	Problem definition (user survey), user group meeting				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	○		

E.1.9 A New Perspectives Approach in National Forest Recreation and its Application to Mountain Bike Management

Kulla, A. 1991. Ohio State University's Professional Development for Outdoor Recreation Managers/Planners Shortcourse.

Andy Kulla is a Recreation Specialist at Lolo National Forest in Missoula, Montana. This paper was written for the Utah State University's Professional Development for Outdoor Recreation Managers/Planners Shortcourse.IMBA cites this article on their website.

The paper recommends ways of adapting recreation management for limited budgets and increased workloads through increased user involvement and ownership. The intent is to "fully empower recreation user groups to promote care for the land and the development of coalitions that emphasize positive relationships between different types of recreationists." In particular, the goal is to empower user groups to care for the land, develop positive relationships with other recreationists, build coalitions with other groups, and do so in prior to the conflict stage.

Kulla argues the need for soft programs, such as working with groups on issues before they arise, rather than merely the hard programs of maintenance, trail improvement, etc. He recommends the following formula for involvement:

1. Identify whether the conflict is an emerging issue.
2. Determine who is interested in, or involved with, the issue.
3. Describe the situation, including public input.
4. Develop objectives for the manager and the users involved in the issue.

5. Work with interested and affected people, groups, agencies, and companies.

Kulla applies this formula to mountain bikers in Missoula, Montana. He works with the group, Low Impact Mountain Bicyclists of Missoula (LIMB), which is a MOU between a mountain bike user group and the Lolo National Forest. The group formed five committees: an advisory group, a media group, a project opportunities group, an ambassadors group, and a membership group.

In the appendix, Kulla presents "A Hierarchy of Solutions to Mountain Bike Impact Emphasizing User Participation." Solutions (generally presented in ranked order of least to greatest impact) include: signing, peer pressure, education, use roads (wider than trails), training programs, design, barriers, walk your bike, one-way only, post speed limits, patrolling, restrict cyclists by time, restrict cyclists by day, separate sections, construct separate routes, zoning, and close trail to cyclists. Interestingly, most of the last solutions (considered the most successful) involve restricting mountain bikers.

Keywords:	Design guidelines, trail layout/availability, education, user group notification, user group meetings, user information, alternate use days, enforcement				
Objectivity:	◑	Applicability	●	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.1.10 Conflicts on Multiple-Use Trails: Synthesis of the Literature and State of the Practice

Moore, R. L. 1994. www.americantrails.org/resources/ManageMaintain/MooreConflictMgmt.html

Conflicts on Multiple-Use Trails (1994) is a well-referenced guide to trail user conflicts. The article is a synthesis of existing literature created by the National Trails Training Partnership for the Federal Highway Administration (FHWA). IMBA cites this article on their website. The article provides guidance for reducing user conflict through information, education, regulations, and enforcement.

Moore cites many other peer-reviewed articles, upon which he bases his conclusions. He notes that many trail managers and professional experts were involved in the research for and writing of the report.

Moore briefly discusses maintaining user safety, citing the following threats to user safety: collisions, reckless and irresponsible behavior, poor user preparation or judgment, unsafe conditions related to trail use (e.g., deep ruts, tracks on snow trail, etc.), unsafe conditions not related to trail use (e.g., obstacles, terrain, weather, river crossings, etc.), poor trail design, construction, maintenance or management, and other hazards (e.g., bears, lightning, cliffs, crime, etc.). His recommendations for maintaining safety on the trail include manager control or influence over the following factors:

- User speed (often has more to do with speed differential than speed itself)
- Mass of user and vehicle (if any)
- Sight distances
- Trail width
- Trail surface
- Congestion (e.g., number of users per mile)
- Users overtaking one another silently/without warning
- Trail difficulty (obstacles, terrain, condition, etc.)
- User skill level and experience
- User expectations and preparedness (e.g., walkers who understand they may see bicycles on a particular trail can better

prepare themselves for possible encounters)

- Emergency procedures
- On-site management presence

Moore focuses his analysis on conflicts between users, noting that no actual contact between users is necessary for conflicts to occur. He states that, "conflict has been found to be related to activity style (mode of travel, level of technology, environmental dominance, etc.), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance for others, and different norms held by different users." Conflicts arise and are exacerbated by many factors, including an increased demand for trail resources, increased use of existing trails, poor management, under-designed facilities, lack of user etiquette, and disregard for the varying abilities of trail users.

Moore identifies the following 12 principles for minimizing user conflicts on multi-use trails. The principles relevant to this study are listed below:

- Recognize conflict as goal interference.
- Provide adequate trail opportunities.
- Minimize number of contacts in problem areas.
- Involve users as early as possible.
- Understand user needs.
- Identify the actual sources of conflict.
- Work with affected users.
- Promote trail etiquette.
- Encourage positive interaction among different users.
- Favor "light-handed" management.
- Plan and act locally.
- Monitor progress.

Moore lists specific techniques that have been used for reducing user conflicts, separating responses into two categories: physical responses (i.e., design trails in a way that encourages users to behave in more appropriate ways) and management responses. Management responses are divided into "information and education" and "regulations and enforcement."

Keywords: Problem definition (theoretical), design guidelines, trail layout/availability, education, user group notification, volunteer programs, events, user group meetings, user information

Objectivity:	●	Applicability	●	Sustainability:	◑
Thoroughness	●	Useful Information	●		

E.1.11 Cactus Forest Trail Environmental Assessment, Saguaro National Park, Arizona

National Park Service, Department of the Interior. 2003. National Park Service. (Public Review Draft)

This Environmental Assessment published by the National Park Service considers the impacts of reopening a section of the Cactus Forest Trail to mountain biker use. The trail had allowed mountain bikers but was closed due to "claims by an organization of environmental professionals that the trail was initially opened without proper authorization." The three alternatives considered included (1) keeping the trail closed to mountain bikers, (2) reopening the trail to mountain bikers, and (3) opening the trail to equestrians and mountain bikers on alternate days.

During the six month trial period, the park collected information on the amount of use, total number of complaints and compliments, major and minor incidents, and unauthorized mountain bike use in other areas of the park. The Service's stated visitor safety goal was to "identify recognizable threats to the safety and health of persons and to the protection of property." They recorded approximately 1,200 mountain bikers, representing nearly half of trail users. Three minor and no major conflicts occurred during that period: a complaint that a bicyclist yelled at a hiker; a complaint that three mountain bikers were riding too fast; and a ranger report that a bicyclist was stopped and advised to yield to equestrians.

The analysis found that "Visitor Use, Understanding, and Appreciation" may be increased for bikers and equestrians if mountain bikers were prohibited from the trail, but "given the number of other trails within the park that are closed to mountain bikes the impact to hikers and equestrians would be localized and of negligible to minor intensity." Impacts to local mountain bikers were seen as "adverse and long-term." Reopening the trail to mountain biker use would be beneficial for mountain bikers, and impacts to hikers and equestrians were seen as, "adverse, long-term, and minor." For visitor safety, the Environmental Assessment concludes that the impact of reopening the trail to mountain bikers would be negligible to minor, stating that, "given the past record of incidents on this trail, however, reinstating mountain bike use would not be considered an unsafe use if recreationists continued to abide by the required trail etiquette rules of the trail."

The discussion of the alternating days scenario noted that, while the potential for conflict would be reduced, "some recreationists may feel constrained, and others may be displaced," which was considered "adverse, short- to long-term, and of negligible to moderate intensity depending on the individual," with respect to impact. The safety evaluation found that, "the potential for accidents could vary depending on such factors as the ability of the rider and the number of other cyclists and hikers on the trail. Past incident reports, however, do not indicate that safety was an issue between bicyclists and other trail users."

The document concludes that the preferred alternative is to reopen the trail to mountain bike use, as not doing so would impact visitor safety and have "adverse, long-term, negligible to minor impacts."

Keywords: Problem definition (count/incident data), alternate use days

Objectivity:	●	Applicability	●	Sustainability:	◑
Thoroughness	●	Useful Information	●		

E.1.12 Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedures

Rouphail N., J. Hummer, J. Milazzo II, P. Allen. 1998. FHWA.

Developed for the Highway Capacity Manual (HCM) for the 2000 update, this report presents a level of service (LOS) methodology for shared-use trails based on traffic-flow theory. LOS is the measure-of-effectiveness used to determine the flow of users on transportation infrastructure, based on passing and overtaking movements. The HCM recommendations are based on assumptions regarding the average speeds and speed distributions of bicycles and pedestrians and do not provide capacity or appropriate speeds for facilities.

The FHWA report, *Evaluation of Safety, Design, and Operation of Shared-Use Paths* (2006) notes several issues with the methodology used in this report:

- The LOS models are based in part on field data from The Netherlands, but have not been compared to U.S. data, on paths that are typically wider and with different bicycle types and skill levels.
- The procedure does not account for "passive passings" wherein the test bicyclist is passed by a faster user.
- The procedure assumes adequate room for passings, rather than "delayed overtakings" when users queue in order to pass.
- The procedure was developed with mopeds and tandem bicycles, but the presented model accounts for only bicyclists and pedestrians.
- The analysis assumes a single average speed for pedestrians and bicyclists.
- The analysis provides guidance for two-lane paths (8-feet wide) and three-lane paths (10-feet wide) exclusively.

Keywords: Problem definition (general), design guidelines

Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.1.13 Characteristics of Emerging Road and Trail Users and Their Safety

Sprinkle Consulting. 2004. FHWA-HRT-04-104.
http://www.fhwa.dot.gov/publications/research/safety/04104/roadstechbrief.pdf

Prepared as part of the Pedestrian and Bicycle Safety Research Program, this FHWA report presents design features of 'emerging' nonmotorized road and trail users, including inline skaters, recumbent bicycles, and Segways for road and trail design standards. Data were collected to better understand the physical dimensions and operational characteristics at 21 data collection stations at three shared-use paths across the U.S. "Rides for Science" were publicized at the San Lorenzo River Trail in California, the Pinellas Trail in Florida, and the Paint Branch Trail in Maryland to encourage participation by targeted user groups.

Data collected include the following:

- Physical dimensions, including length, width, height, eye height, wheelbase, wheel spacing, wheel diameter, tire/wheel width, and tire type.
- Space required for a three-point turn.
- Lateral operating space (sweep width).
- Turning radii.
- Acceleration capabilities.
- Speed.
- Stopping sight distance and time (perception/reaction and braking distances).

The article provides 85th percentile performance values for design speed, stopping sight distance and horizontal alignment and compares the needs of these emerging user groups with existing AASHTO standards for bicycle and pedestrian facilities. The document provides specific, researched design needs of users on paved paths, although it does not address users on unpaved paths or equestrians.

Keywords:	Width/passing areas, design speed				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.1.14 A Review of the Literature for a Comprehensive Study of Visitor Safety in the National Park System

Tuler, S., Golding, D., Krueger, R.J. 2002.
http://www.californiatrails.org/documents/NationalParkServiceSafety.pdf

This article reviews literature about hazards, accidents and risks, especially those that may apply to visitors to National Parks. This article broadly covers the circumstances, behaviors and physical/psychological factors that contribute to hazardous situations, including natural disasters, weather, communication, preparedness, infrastructure, user characteristics, etc. The authors evaluate crowding and user conflict as contributors to stress that may induce risky behavior and physical harm. Several referenced studies examine bicycle-hiker conflict, which are included individually in this analysis.

Keywords:	Problem definition (theoretical)				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.1.15 Equestrian Design Guidebook for Trails, Trailheads, and Campgrounds

United States Department of Agriculture Forest Service. 2007. 0723–2816–MTDC
http://www.fhwa.dot.gov/environment/fspubs/07232816/pdf07232816dpi72all.pdf

This guidebook was published by the U.S. Forest Service, in cooperation with FHWA and funded by RTP. The document provides practical guidance for designing trails and other facilities for use by equestrians. It summarizes considerations for planning with horses in mind, including a 4-foot estimated width of the horse with a rider.

The planning trail systems chapter provides a list of questions for determining whether a trail is suitable for equestrian use. Questions pertinent to this Study include:

- Is the trail corridor wide enough to accommodate many trail users, including stock and their riders? Is the anticipated trail appropriate for equestrian use?
- Is the trail corridor free of hazards or potential safety problems that would affect riders? Do trail conditions, such as separate treads for different non-motorized users, promote a sense of safety?

While these questions show how trail design can influence user safety, the second bullet implies that physical design can influence perceptions of safety. The report refers to Moore (1994) for additional information on interactions between trail users.

The document quotes IMBA's trail etiquette, which includes, "Give animals extra room and time to adjust to you. When passing horses, always use special care and follow directions from the horseback riders (ask if uncertain). Running cattle and disturbing wildlife is a serious offense. Leave gates as you found them, or as marked."

Specific guidelines for designing trails to accommodate equestrians include the consideration that stock tend to travel about 18 inches from the edge of the tread surface, and have an approximately 2-foot shy distance from obstacles. The guide recommends a 5- to 6-foot tread with 'adequate clearance.'

A call-out box discussing 'Mixing Bicycle and Horse Use' states that equestrians' and bicyclists' ability to share a trail may reflect the local cycling style and local circumstances or customs. The guide explains the prevalence of separating users as being because the sudden appearance of bicyclists can unnerve stock, as well as equestrians' desire to ride on an natural surface surface. It provides guidelines for multiple tracked trails, including treads separated by distance. Additional guidelines pertain to recommended sight distance, tread and clearing widths, turn radii and switchbacks, and design of crossing features.

Keywords: Problem definition (general), design guidance, width/passing area, gradient design speed, sight lines, trail layout/availability

Objectivity:	●	Applicability	◑	Sustainability:	◑
Thoroughness	●	Useful Information	◑		

E.2 General Guidelines and Studies

E.2.1 Lightly on the Land: The SCA Trail-Building and Maintenance Manual

Robert C. Birkny and The Student Conservation Association, 2008

The Student Conservation Association (SCA) is a service organization dedicated to conservation and stewardship of wilderness, parks and nature sanctuaries. Their recommendations for design are developed from years of in the field experience building and maintaining trails through sensitive environmental areas.

This book is a comprehensive manual for natural surface trail construction and maintenance, covering topics of tools, design, drainage and working with various construction materials. Introduced into the second edition is a discussion of relationship building between land managers and volunteers, as well as an emphasis on sustainable trails to require a minimum level of maintenance.

This book does not discuss strategies to address trail user conflicts. The authors do discuss managing user behavior to prevent trespassing into sensitive environmental areas, with Birkney suggesting the use of physical barriers with control points on each end to prevent unwanted access. Beyond physical diversion, removal of tracks and/or planting vegetation can provide the sense that an area is being actively maintained, discouraging off-trail access.

Keywords: Design guidance, width/passing areas, design speed, sight lines, trail layout/availability

Objectivity: ◑ Applicability ◑ Sustainability: ◑

Thoroughness ● Useful Information ○

E.2.2 Greenways: A Guide to Planning, Design and Development

Flink, C. A., and R. M. Searns. 1993. Washington, D.C.: Island Press.

The authors are professional designers and planners who provide recommendations based on professional experience. This guide presents guidance for trail visioning, planning, design and construction process. Thorough descriptions of processes and step-by-step guidance walk the reader through designing a trail.

The book stresses the importance of designing greenways with specific users in mind to address safety concerns. Decisions about which user groups to accommodate should be based on an evaluation of the needs and desires of the community. Trail users can be grouped into two main categories: motorized and nonmotorized. Within this categorization, subcategories include: pedestrian, nonmotorized vehicular, nonmotorized water, pack and saddle animal users, motorized, and motorized water trail users.

Flink and Searns define a design-based framework for managing potential safety issues by classifying and designing trails as single/multiple use and single/multiple treads. Multiple-tread, multiple use trails can resolve safety issues through user segregation. Single-tread, multiple use trails can have usage-control features, such as signs or striping to separate trail users. Time of use restrictions may also be used to manage single use trail conflicts by limiting trail use to a single user group at different times, days, or months.

Establishing a trail user ordinance can resolve user conflict by requiring users to restrict speeds and manage passing, overtaking, behaviors at crossings, and other locations with a higher potential for incidents. While ordinances alone do not resolve these issues, they do provide a framework for enforcing uniform trail use regulations.

This book provides a practical framework for understanding users and trail typologies to establish the appropriate safety and user conflict strategies available.

Keywords: Problem definition (general), design guidance, width/passing areas, design speed, user information, alternate use days, enforcement

Objectivity: ◑ Applicability ● Sustainability: ●

Thoroughness ● Useful Information ●

E.2.3 Trails for the Twenty-First Century

Flink, C., Olka, K., Searns, R., Rails-to-Trails Conservancy. 1993. Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails. Island Press.

Trails for the Twenty-First Century was authored by Flink, Olka, and Searns, who are trail planning and designing professionals, along with the Rails-to-Trails Conservancy and the National Center for Recreation and Conservation Division of the National Park Service. The second edition was sponsored by the Federal Highway Administration (FHWA).

The book "was written to help those who are planning, designing, building, and managing multi-use trails" and presents a thorough discussion of considerations for both paved and soft-surface trails, as well as designing trails to accommodate multi-use.

Flink, Olka, and Searns advocate for designing trails with specific users in mind to avoid conflict and unsafe trail conditions. *Trails for the Twenty-First Century* states that speed issues are better addressed through design, as speed limits require consistent, ongoing enforcement and may not improve real or perceived safety on the trail. Where speed limits are created, strategies to increase compliance can include informing users of the regulations, communicating the reasons for regulations to the users affected, and considering sentencing trail offenders to work service on the trail as part (or all) of their penalty.

They propose six alternative layouts for land-based trails, varying single or multiple treads, and responding to the number of user types. Users can also be separated via time of use, zoning, and skill levels or preferences.

The book presents a case study on 'Resolving Conflicts between Cyclists and Equestrians' that highlights ROMP n' STOMP events where equestrians and mountain bikers use trails together to build partnerships and mutual understanding. The recommended response to conflict issues is therefore to improve perceptions of other users.

Keywords:	Problem definition (general), design guidance, width/passing areas, design speed, sight lines, trail layout/availability, education, alter nature use days, rules & regulation, enforcement				
Objectivity:	●	Applicability	◑	Sustainability:	◑
Thoroughness	●	Useful Information	◑		

E.2.4 Trail Planning, Design, and Development Guidelines

MN Dept of Natural Resources. 2006. St. Paul, MN: State of Minnesota.

This guidebook seeks to establish a consistent set of guidelines for motorized and non-motorized trails, developed through practices common to Minnesota. The guide covers planning, design, materials, and special considerations for winter-use trails. The book promotes proper trail design to manage speed, increase safety, and reduce conflict.

The guide provides typical design dimensions to accommodate different types of users for travel and maneuvering. Failing to accommodate the expected types and volume of users could lead to increased levels of conflict and increased propensity for accidents.

Varying travel speeds can be managed through the use of different design patterns. Introducing a curved path or other visual cues can slow users to appropriate speeds where necessary. In some cases, design speeds cannot be easily artificially lowered, and the trail should be designed to accommodate higher speeds. Other considerations to promote safety include appropriate curve radii, gradients, clearance zones, and sight distances. On paved trails, the authors recommend use of pavement markings and white/yellow lines to establish expectations for users of shared-use paths.

This guide is comprehensive in its approach to trail design and maintenance, and offers a strong basis for understanding the operating space needs of different users. The guide focuses on design approaches as the foundation for managing safety issues and user conflict.

Keywords: Problem definition (general), design guidelines, width/passing areas, gradient, design speed, trail layout/availability, user information

Objectivity:	●	Applicability	●	Sustainability:	●
Thoroughness	●	Useful Information	●		

E.2.5 Results of the Two Year Mountain Bicycle Trail Study

North Carolina Division of Parks and Recreation. 1993. North Carolina Division of Parks and Recreation, Department of Environment, Health and Natural Resources.

This study was conducted by the North Carolina Division of Parks and Recreation (NC CSP) in response to the department's recognition that its "lack of mountain bicycle trail management experience would make it difficult to reach or defend any decision to permit or deny mountain bicycling use within units of the state park system." It was developed by a Quality Action Team comprised of:

- Walt Gravley, Superintendent, South Mountains State Park.
- Ob Davies, Chief Ranger, William B. Umstead State Park.
- Marshall Ellis, Natural Resource Management Section.
- Darrell McBane, State Trail s Coordinator.
- Tom Potter, Regional Trails Specialist.
- Dwayne Stutzman, Regional Trails Specialist.

IMBA cites this article on their website.

NC CSP initially surveyed other state parks systems to gather information on how to manage mountain bikers. However, the information was inconclusive, and a two-year study was commissioned. Mountain bikers were allowed on designated multi-use trails in William B. Umstead State Park and South Mountains State Park, and significant data was collected to support the conclusions.

One of the surfaces tested in the experiment was an 8-foot wide roadbed with a compacted soil surface; other trails were paved or wider. Criteria selected to study the effects of mountain bikers included natural resource protection, visitor safety, operational impacts, and user satisfaction. Visitor safety was measured by case incident reports filed and user comments.

Three incidents occurred during the study period; all were accidents that did not involve other users. Staff did receive several verbal comments, predominantly from equestrians who questioned mountain bikers' presence on the trails, in particular on the first half-mile of trails from the parking lot. Complaints included mountain bikers weaving in and out of traffic and passing too closely to hikers at high speeds and without warning.

NC CSP also found that an average of two staff-hours per week were required to monitor the multi-use trail conditions, while 10 staff-hours were required to respond to complaints resulting from mountain biker use. In addition, mountain bikers noted that the wide road was a less-desirable trail than a narrower 18- to 24-inch singletrack. The report recommends having mountain bikers walk near the trailhead, where more users are present.

Keywords: Problem definition (count data), design guidelines, width/passing areas, user information

Objectivity:	●	Applicability	◑	Sustainability:	●
Thoroughness	●	Useful Information	◑		

E.2.6 Natural Surface Trails by Design: Physical and Human Design Essentials of Sustainable, Enjoyable Trails

Parker, T. S. 2004. Boulder, CO: Natureshape.

This book covers the philosophy and design behind natural surface trail development. Common problems are identified and solutions are discussed. User conflicts are not covered in this book.

Keywords: Design guidelines

Objectivity:	◑	Applicability	◑	Sustainability:	●
Thoroughness	◑	Useful Information	○		

E.3 State Guidelines and Studies

E.3.1 Trail Planning for California Communities

Bondurant, J., L.Thompson et. al... 2009. Solano Press Books

This 400-page book is a comprehensive guide for recreational trail planning. The primary authors are (Bondurant) a Senior Park Planner with EBRPD and (Thompson) the manager of the San Francisco Bay Trail Project. Many other "contributing partners" also assisted with the development of the guide.

The guide presents detailed recommendations about policy and regulation, community involvement in trail building, legal responsibilities, trail design, permitting, funding, and maintenance. It describes and proposes designs that separate users or serve particular groups of users, and references existing, successful trail designs and planning measures.

Trails particularly relevant to this Study are fire roads and wildland trails, although the guide does not provide specific instructions for selecting width or mitigating user conflicts on a single-track.

Bondurant presents a wide range of design, planning, and management considerations and specifications. Those that are pertinent to this Study are included in the findings and recommendations in the Study.

Keywords: Problem definition (general), design guidelines, width/passing areas, gradient, design speed, sight lines, trail layout/availability, user information

Objectivity:	●	Applicability	●	Sustainability:	◑
Thoroughness	●	Useful Information	◑		

E.3.2 California State Parks Accessibility Guidelines

California State Parks. 2005.

The Accessibility Guidelines provide general information related to laws and regulations for Parks and Recreation staff. Section 40 addresses issues for trails. The guidelines state that "trails provide the means for the activity of hiking." The guide recommends installing and maintaining accessible trails wherever hiking is considered one of the primary activities or where there is a large concentration of trails. Specific guidelines are provided for running and cross-slopes, resting spaces, obstacles, and other design features.

Keywords:	Design guidelines, width/passing areas, gradient				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.3.3 California Highway Design Manual Chapter 1000

Caltrans. 2009. http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

The California Highway Design Manual (HDM) defines a Class I Bikeway or Bike Path as "a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow by motorists minimized." When defining Class I bikeways, the HDM states that, "experience has shown that if significant pedestrian use is anticipated, separate facilities for pedestrians are necessary to minimize conflicts. Dual use by pedestrians and bicycles is undesirable, and the two should be separated wherever possible." The guidance is primarily related to on-street bikeways and paved shared-use paths.

The guidance establishes the minimum design speed for a bike path as 25 miles per hour, except where mopeds are permitted or where located on a long downgrade, where design speed should be 30 mph. The HDM clearly discourages the use of bicycle traffic calming on shared-use paths, stating that, "Installation of 'speed bumps' or other similar surface obstructions, intended to cause bicyclists to slow down in advance of intersections or other geometric constraints, shall not be used. These devices cannot compensate for improper design." The HDM recommends barrier posts exclusively to discourage motorized vehicle use of the path and not for slowing bicyclists.

The HDM encourages separation between bicyclists and pedestrians, as well as alternative treatments to reduce safety issues, including additional width, signing and pavement markings.

Keywords:	Design guidance, width/passing areas, design speed				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.3.4 California Manual on Uniform Traffic Control Devices

Caltrans. Draft 2011.
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2011_draftrevisions.htm

The California *Manual on Uniform Traffic Control Devices* (CAMUTCD) provides guidance for the use of signs and pavement markings on roadways and bikeways in California. The CAMUTCD discusses use of the 'Shared-Use Path Restriction' sign (R9-7; Section 9B.11).

Chapter 9C provides guidance for the use of pavement markings on shared-use paths. The CAMUTCD offers the option of marking patterns and colors on shared-use paths, stating that, "Where shared-use paths are of sufficient width to designate two minimum width lanes, a solid yellow line may be used to separate the two directions of travel where passing is not permitted, and a broken yellow line may be used where passing is permitted (Section 9C.03).

The CAMUTCD recommends the use of centerline markings, particularly in the following circumstances:

- Where there is heavy use;
- On curves with restricted sight distance; and,
- Where the path is unlighted and nighttime riding is expected.

Keywords: Design guidelines, user information

Objectivity: ● Applicability ● Sustainability: ○

Thoroughness ◑ Useful Information ◑

E.4 Local Jurisdiction Guidelines and Studies

E.4.1 Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers

Anderson, D.H., Lime, D. W., and T.L. Wang. 1998. St. Paul: University of Minnesota Extension Service. http://cpsp.cfans.umn.edu/publications/revtactics_handbook.pdf

Background and Context

This handbook provides resource managers with a step-by-step, easy-to-use process for identifying and defining unacceptable impacts to biological and cultural resources and to visitor experiences, and identifies strategies and tactics to address unacceptable impacts to resources and experiences. The handbook was commissioned by the National Park Service (Denver Service Center) as a complement to the Visitor

Experience and Resource Protection (VERP) framework.

The handbook was field-tested in 1997 in four National Park Service units (Arches, Mesa Verde, Grand Teton, and Yellowstone national parks) and is built on the publications by Cole, Petersen, and Lucas (1987), *Managing wilderness recreation use: Common problems and potential solutions*; and Cole (1989b), *Low-impact recreational practices for wilderness and backcountry*.

Methodology

The handbook defines a decision process of five stages: (1) problem awareness, (2) problem specification, (3) strategy and tactic selection, (4) plan implementation, and (5) monitoring. Problems are defined as unacceptable visitor-caused impacts to biophysical resources and visitor experiences.

Findings

Problems related to visitor experiences include:

- Visitor conflicts due to incompatible uses, encounters with large groups or parties dissimilar to one's own, or rowdiness by itself or in combination with excessive consumption of alcohol and visitor displacement (spatial, temporal, or total).

- Inadequate or inappropriate levels of access to facilities, natural areas, or cultural resources; facility design that fails to accommodate the needs of the broadest possible spectrum of people, including persons with disabilities.
- Threats to visitor safety, behavior that jeopardizes the safety of the individual or of other visitors, failure to maintain a safe environment through facility design, maintenance, or other means.

The handbook provides three worksheets associated with the decision process, which are used for problem specification, to define what the acceptable resource condition would be and what the existing impact is, and finally the possible causes of any impacts that are determined to be unacceptable or approaching unacceptable levels. If indicators or standards are not prescribed for a given impact, the manager determined what is acceptable or how much impact can be tolerated before management intervention is required.

The handbook outlines five general management strategies to address unacceptable impacts:

- "Modify the character of visitor use by controlling where use occurs, when use occurs, what type of use occurs, and how visitors behave.
- Modify the resource base by increasing resource durability or maintaining/rehabilitating the resource.
- Increase the supply of recreation opportunities.
- Reduce use in the entire area, or in problem areas only.
- Modify visitor attitudes and expectations."

Strategies included in the workbook include: site management, rationing and allocation, regulation, deterrence and enforcement, and visitor education.

The second half of the handbook describes specific treatments. The section on site management primarily addresses environmental impacts with recommendations for facility design to maximize compatibility with adjacent uses and other aesthetic qualities, as well as reducing conflicts between users, but it does not provide specific guidelines such as minimum widths or sight lines. Non-regulatory recommendations to reduce user conflicts include site management, rationing and allocation, deterrence and enforcement, and visitor education.

Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers recommends the following selection criteria for management tactics:

- Does the tactic adequately address the root cause of the visitor use problem?
- Is the tactic direct or indirect in terms of how it operates on visitor behavior?
- Is the tactic subtle or obtrusive in terms of visitor awareness of being managed?
- Does the tactic preserve visitor freedom of choice?
- Does the tactic affect visitors offsite during the planning stages of their trip? Or does the tactic affect visitors onsite while they are engaged in their recreational experience?
- Does the tactic affect a large or small number of visitors? Are those affected primarily visitors who are generally not responsible for the impact(s) in question?
- Does the tactic affect an activity to which some visitors attach a great deal of importance?
- Are visitors likely to resist the management action?
- What are the costs to managers in terms of tactic implementation and administration, including facility construction, operation, and maintenance, staff workload, and communication and enforcement costs? Are any of these limiting factors?
- How effective is the tactic likely to be at solving the visitor use problem in question?
- Is the tactic likely to lead to the creation of a new problem?

(Anderson, Lime, and Wang, 1998)

Site management strategies aim to "direct and channel use" and primarily address environmental concerns though resource hardening, increasing/decreasing the number of facilities, improving/not improving facilities, and closing areas. The authors state that curvilinear design "may be used to eliminate unacceptable impacts to visitor experience." One specific recommendation related to mitigating conflict issues is to use a rope or fence barrier to separate pedestrians travelling in different directions. Another is to provide additional trails to reduce congestion on popular trails.

Rationing strategies address localized visitor use problems and include limiting access via reservations, queuing (first-come first-serve) system, lotteries, merit/eligibility system, and charging fees. The majority of these refer to public versus private uses or reservation/permitting systems, which are less appropriate at for single-day use due to the work involved with issuance and enforcement. The authors note that sanctions can be effective, but at high cost to management. The authors also state that the management problem is often the distribution of recreationists, rather than the total number, so these strategies should be coupled with other management techniques.

Deterrence and enforcement strategies include providing signs, sanctioning visitors who engage in noncompliant behavior, and providing personnel and law enforcement. The authors recognize that, while signs are an important accompaniment to policies and education, success relies on user attention. They conclude that personnel and law enforcement can serve as an effective reminder of regulations.

The chapter on visitor education defines key conditions for visitor education to be effective: visitors must regard the behavior advocated by park managers as personally desirable and important messages must be communicated so they facilitate visitor acceptance. Education is more effective in combination with other tactics, and the authors state that, "educating visitors about appropriate behavior will be more effective when visitors: (1) are highly motivated to change their behavior to protect the biophysical environment, (2) are motivated to adjust their behavior so it better reflects values toward natural and cultural areas they already hold, and (3) understand the reason for the management action."

The section addressing regulation discourages managers from using regulation where effective non-regulatory alternatives exist. Regulatory strategies that can address user conflicts include the following:

- Restrict access to specific locations (zoning) – ensure that only regulations necessary to realize management goals are implemented.

Restrict/prohibit activities – a highly obtrusive regulation that can "lead to a strong sense of 'being managed' on the part of the visitor which can lead to a climate of conflict.

Keywords: Problem definition (theoretical), trail layout/availability, education, user information, alternate use days, rules and regulations

Objectivity:	●	Applicability	●	Sustainability:	●
Thoroughness	●	Useful Information	●		

E.4.2 Recreation Conflict at Six Boulder County Parks and Open Space Properties: a Baseline Study

Bauer, M. 2004. http://www.californiatrails.org/documents/ConflOutdoorRec2.pdf

This report on a user survey conducted in Colorado provides baseline data on perceived user conflicts in six county parks, informing management decisions and future surveys. It was prepared by an interpretive specialist at Boulder County Parks and Open Space and reviewed by an independent leisure studies consultant, Marcella Wells, Ph.D.

The study directly asked respondents if and how others interfered with their goals or enjoyment of the trail, considering hikers, bikers, pedestrians, and dog walkers. The study found that the majority of users never experienced conflict and only two percent experienced conflict on the day of the survey. Overall, a third of respondents reported that they had even experienced conflicts with other users on the trails. Pedestrians are more likely than mountain bikers to perceive conflict associated with speed, yielding and communication on behalf of bikers, whereas bikers reported little conflict with pedestrians. Other concerns included dogs being off-leash and the presence of horse feces.

The survey did not ask about the nature of the conflict; whether users had to stand aside to let another user pass, felt physically unsafe, or if the presence or actions of other users detracted from their experience. The prevalence of reported complaints and infrequency of incidents is commensurate with other reports.

Keywords:	Problem definition (user survey)				
Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.4.3 Managing Recreational Mountain Biking in Wellington Park, Tasmania, Australia

Chiu, L. and L. Kriwoken. 2003. Annals of Leisure Research. 6:4, 339-361

Written at the University of Tasmania, Australia, this article examines management strategies for recreational mountain biking for the Wellington Park Management Trust. Study methods include a questionnaire survey of mountain bikers and other park users, as well as an environmental impact study of mountain biking. The study was conducted in Wellington Park, Tasmania, an 18,250 hectare park that has about 250,000 visitors a year. A separate survey form was developed for mountain bikers and for other users, asking reasons for visiting the park, recreational setting and track preferences, perceived user-group conflicts, and preferences for different management options. IMBA cites this article on their website.

The survey found that conflicts between mountain bikers and other recreational users were uncommon and users were generally tolerant of mixing uses. Mountain bikers and other users tended to visit the park for the same reasons ('exercise' and 'appreciation of nature/scenery'), although mountain bikers also came for 'socializing' and 'excitement/risk', while other users also responded 'relaxation.' Non-bikers' concerns are primarily related to bikers travelling at excessive speeds and not giving a warning on approach. All users' preferred management strategy was self-regulation, while non-mountain bikers were more likely to desire a code of conduct and right-of-way principles.

The study recommends informing other users of mountain bikers' legitimate right to a trail, encouraging other users to be prepared for an encounter. Design solutions to managing safety issues include "leaving obstacles and rough surfaces to slow users down; re-routing tracks on low slope angles across hills rather than straight up them; and avoiding sharp corners on steep descents." The authors also recommend user education, particularly about the needs of other users and appropriate behavior, as well as maintenance to minimize safety concerns and environmental damage. The questionnaire inquired about users' perceptions of each management technique, and did not determine their efficacy.

Keywords:	Problem definition (user survey), speed control features, sight lines, education, user information				
Objectivity:	◑	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.4.4 Trail Design Guidelines for Portland's Park System

City of Portland Parks & Recreation. 2009. atfiles.org/files/pdf/DesignGuidelinesPortland09.pdf

Design guidelines for Portland's trail system were developed by Portland Parks & Recreation (PP&R) in 2009 after the City's Parks 2020 Vision identified a lack of trail standards to be an issue.

The guidelines are developed from PP&R's experience with the trail system in Portland, and included a list of contributors and reviewers.

The first issue considered in the guidelines' design philosophy is safety. While the discussion primarily addresses user separation from motor vehicles, it also notes that different trail users may travel at differing speeds. Accessibility is another design philosophy, which highlights PP&R's desire to provide trails at a range of challenge levels. The guidelines recommend public process and review by the Portland Citizens' Disability Advisory Committee (PDAC) to determine what level of accessibility a given trail should provide.

The guidelines provide design and use standards for all types of single use trails, as well as multi-use trails. The trail type pertinent to this Study is Type J: hiking/mountain biking trails (equestrian use is allowed). The guidelines clarify the equestrians and dog walkers are minor uses on hiking/mountain biking trails, while mountain bikers are not allowed on hiking/equestrian trails. Mountain bikers, equestrians, and hikers are also allowed on fire roads or wider gravel trails.

Hiking/mountain biking trails/equestrian trails should be 4 feet wide with passing areas at a minimum, 10 feet maximum width. The easement width should be 10 feet in addition to the tread width. Native herbaceous plants can be allowed to revegetate all but the trail bed. The discussion noted that these widths allow side-by-side hiking or riding, or room for on-coming or overtaking trail users. Grades should be 0 to 5 percent slope or up to 12 percent as needed, but the trail does not have the obstacles desired by expert riders. These trails should be ADA-accessible, although the surface is not reliably firm and slip resistant. Sight distance should be 40 to 100 feet, "depending on speed/flow," and turn radii should be 10 feet minimum. The guidance also recommends retaining large stable round rocks at the surface of the trailhead, while removing pointed or loose stones.

Hiking and equestrian trails are designed for single-file walking, running, and horse riding. Dogs must be on leash. Trail width should be 4 to 10 feet with an additional 10 feet for the easement. Standard grades are 0-12 percent slope (5 percent maximum preferred). Sight distance is 50 to 100 feet and turning radius guidance is to "avoid sharp turns." In addition, the guidance states that, "Bicycles are specifically not allowed in order to not startle more nervous horses."

Keywords:	Design guidelines, width/passing areas, gradient, design speed, trail layout/availability, sight lines				
Objectivity:	●	Applicability	●	Sustainability:	●
Thoroughness	●	Useful Information	●		

E.4.5 City of San Jose Council Agenda 03-29-11: Trail Safety Enhancements

City of San Jose. 2011. http://www.sanjoseca.gov/clerk/Agenda/20110329/20110329_0501.pdf

This memorandum on trail safety enhancements was produced by Albert Balagso, Director of Parks, Recreation and Neighborhood Services and David Sykes, Acting Director of Public Works. The memorandum recommends that San Jose's Mayor and City Council accept the staff report and work plan to install new signage, striping, and mileage markers along City trails. The report is the result of an accident on the Los Alamitos Creek Trail, wherein a woman died in September 2009. The report explains the rationale for not pursing a prohibition on bicycle riding with leashed dogs. This memorandum refers to user conflicts on paved trails and is therefore not included in this analysis.

Keywords:	Problem definition (incident data), user information				
Objectivity:	◑	Applicability	○	Sustainability:	○
Thoroughness	●	Useful Information	○		

E.4.6 Trail Signage Guidelines

City of San Jose Trail Program. 2010. http://www.sjparks.org/Trails/Reports/TrailSignageGuidelines_low-res.pdf

This recent planning study for the City of San Jose presents comprehensive guidelines for the development of signs on trails in the City of San Jose. The guidelines include an etiquette sign, which reminds bicyclists to yield to pedestrians and to obey traffic rules. The signs are intended for paved paths, rather than unpaved facilities, and are not relevant to this study.

Keywords:	User information				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.4.7 Forest Park - Access, Circulation, and Parking Study

City of St. Louis Board of Public Service. 2008.
http://stlouis.missouri.org/citygov/parks/forestpark/ParkingReport.pdf

The *Forest Park - Access, Circulation, and Parking Study* was prepared for the City of St. Louis Board of Public Service in 2008 by Crawford, Bunte, Brammeier Traffic and Transportation Engineers. At 1,731 acres, Forest Park is one of the largest urban parks in the United States. Forest Park has a Dual Path System made up of hard surface ('wheels') and soft surface ('heels'), which are paired in a loop along the perimeter of the park. Sidewalks and dirt trails provide connections through the interior of the park.

The study collected more than 50 traffic counts, as well as extensive parking surveys, a thorough walkability/bikeability audit, transit studies, reviews of several previous studies, an in-park user survey, and demographic reviews.

The study indicates that because portions of the dual system are not complete, many pedestrians use the hard surface path. Conflicts arise between bicyclists, skaters, walkers and joggers due to speed differentials. Users report being frustrated when walkers and joggers do not return to the 'heels' path when it resumes. Because pedestrians walk on the hard-surface trails, some bicyclists use the park roads instead of the paths.

The top four park-wide recommendations are for the completion of the dual system so that pedestrians can travel exclusively on the soft-surface trails designated for their use. Another related recommendation is to develop a comprehensive wayfinding signage plan. Opportunities are identified for making the park's roadways friendlier for bicyclists. Another recommendation is to construct the soft-surface (heels) portion of the dual path nearest to the road, as it was observed that pedestrians often have a 'sidewalk instinct' that leads them to use the first path they cross when walking from the road or parking lot. "Share the Road" concepts are also recommended, along with increased lighting and enhanced pedestrian facilities.

Keywords: Problem definition (user survey), trail layout/availability

Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.4.8 Speed Limits on Recreational Bicycle Paths

City of Vancouver, B.C. General Manager of Engineering Services. 1995.
http://vancouver.ca/ctyclerk/cclerk/951207/vtc1.htm

This policy report to the Vancouver Traffic Commission was produced by the General Manager of Engineering Services in Vancouver, British Columbia. In 1994, Vancouver implemented a 15 km/h (9 mph) speed limit for bicyclists on the Seaside Bicycle Route and Stanley Park Seawall for a trial period. This report was written the following year, when the Vancouver Traffic Commission considered whether to retain this speed limit.

Engineering Services recommended retaining the 15 km/h posted speed limit on shared path portions of the Seaside Bicycle Route. Speed checks taken before and after use of the speed limit signs are inconclusive, but show few cyclists exceeding 10 km/h over the limit (6 mph), with average speeds between 17 and 18 km/h (10 to 11 mph).The policy report states that the Bicycle Advisory Committee supports the retention of the speed limit. No money for enforcement was available, and the report concludes that no negative impacts were identified. The 15 km/h signs are still posted as of 2011.

Keywords:	Design speed, user information				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.4.9 Narrow Natural Surface Trails: Managing Multiple Users

East Bay Regional Parks District. 2011.
http://www.ebparks.org/files/ebrpd_Narrow_Trail_Study_FINAL_03_24_2011.pdf

This 2011 study from the East Bay Regional Parks District (EBPRD) identifies and discusses specific management approaches for narrow natural surface trails in the San Francisco Bay Area.

Methodology

The study includes a survey of 15 park and open space management agencies requesting information on their agency's trail use practices, planning policies, environmental review, maintenance activities and enforcement practices.

Findings

The executive summary states the following general consensus findings:

- "Trails designed with multiple use in mind are more successful in accommodating multiple uses, such as hiking, equestrians and bicycling than trying to adapt existing trails for multiple use.
- Designating allowable uses when a trail is initially constructed and opened is more successful in gaining public acceptance that initiating use changes over time, especially in popular parks where existing use patterns are well established.
- Providing regulatory information simultaneously multiple ways through park signage, a web site and staff and volunteer presence serve as the most effective way to reach out and inform trail users.
- Fewer regulations consistently applied and enforced yields greatest compliance."

The survey was an in-depth analysis of park and open space managers' experience with managing multiple uses on narrow natural surface trails. The 15 agencies surveyed by EBRPD have differing standards for narrow natural surface trails, shown in Table E-4.

Table E-4. Agency Definition of Narrow Multi-Use Trails

From *Narrow Natural Surface Trails: Managing Multiple Users* (EBRPD, 2011)

Agency	Agency Definition of Narrow Trails
Marin County Open Space District	3 to 3.5 feet wide with 8 feet of lateral clearance
Midpeninsula Regional Open Space District	6 to 10 feet wide (Class A, widest) 4 to 6 feet wide (Class B, intermediate) 2 to 4 feet wide (Class C, narrowest classification)
Santa Clara County Parks and Recreation Department	4 to 6 foot wide (narrow trails limited to mountain areas)
California State Parks	Less than 60 inches wide (Roads are defined as greater than 60 inches)
East Bay Regional Park District	Less than 8 feet wide

Agencies employ a variety of techniques to manage users on narrow natural surface trails. Key findings are summarized in Table E-5. In addition to these, the survey found that, "Participating managers surveyed noted that some of the strategies being used, especially those intended to control speed (e.g., pinch points, uneven surfaces), may render the trail less accessible to those with mobility impairments." Agencies must balance providing facilities that are suitable for all users.

Table E-5. Findings –Summary of Managers' Survey Findings, *Narrow Natural Surface Trails: Managing Multiple Users* (EBRPD, 2011)

Tool	Strategies that have been successful with participating agencies	Strategies that have created management challenges for participating agencies
Design	Moderate grades Good sightlines Bench width Grade reversals Features to minimize conflict	Combining use on trails not designed for multiple use Design that benefits one user can be an obstacle to another Encouraging speed differential with sustained steep grades
Use Distinctions	Multi-use from day one Plan out uses before opening Design for multi-use intent Construct and restore the land before opening Create opportunity for cooperative use Separate users: Separate by park Separate at trailheads Separate by trail	Combining uses on crowded trails More challenging to safely manage many different uses where use is high Every potential conflict is magnified High use areas require user limitations
Signage	Regulatory/wayfinding signage that clearly communicates What is an official trail and what is not? What people need to know in order to comply What people need to know to recreate at a comfortable skill, mobility level	Lack of signage Leads to confusion Lack of information on conditions can create poor or dangerous trail experiences Add to misuse of existing trails, use of bootleg trails
Enforcement	Consistent enforcement Regulatory compliance on trails requires consistent enforcement This does not come for free Communicate/educate through enforcement	Complex regulations Uphill only One way loop Alternate day Inconsistent Enforcement Low commitment equals limited effectiveness People will do what they think they can get away with People are angry with inconsistency Self Regulation Dependent on a small and local user group Ownership is key, fee and membership base Generally not effective in publicly-managed park lands

The study also addresses outreach and education techniques, noting the difficulty with assessment of these strategies; "The success of outreach and educational programs in promoting compliance with trail use policies varies considerably across the region with no obvious factors determining the difference between success and failure." Nevertheless, several agencies cited education and outreach techniques that they had found to have a positive impact. Examples include the Marin County Open Space District's sponsorship of mountain biking races and running and mountain biking user groups' use of EBPRD's trails for training.

While the survey only briefly addresses environmental impacts of mountain bikes, it does include consideration of management strategies directed at minimizing those impacts.

Keywords: Problem definition (general), design guidelines, width/passing areas, speed control treatments, curvilinear design, education, events, user group meetings, user information, enforcement

Objectivity: ● Applicability ● Sustainability: ◑

Thoroughness ◑ Useful Information ●

E.4.10 Trail Use Guidelines and Mitigation Measures

Midpeninsula Regional Open Space District. 1993.

Adopted by the Board of Directors in January 1993, this document "represents a comprehensive strategy for implementing the Midpeninsula Regional Open Space District Trail Use Policies." It includes trail use guidelines, including the definition of three trail classifications to designate suitable trail uses. Designations are shown in **Table E-6**.

Table E-6. Trail Designations, *Trail Use Guidelines and Mitigation Measures* (Midpeninsula Regional Open Space District, 1993)

	Use	Width (feet)	Grade	Side Slope	Line of Sight
Class A	Hiking, running, equestrian, bicycling	6 to 10	Varying	Varying	>75 feet
Class B	Hiking, running, equestrian, bicycling	4 to 6	<15%	<30%	>100 feet
Class C	Hiking, running	2 to 4	Varying	>30%	>50 feet

Keywords: Design guidelines, width/passing areas, gradient, sight line

Objectivity: ● Applicability ● Sustainability: ○

Thoroughness ● Useful Information ●

E.4.11 Mountain Biking in the Canadian Rocky Mountains: A situational analysis

Mosedale, J. 2002. The Canadian Environmental Network.

This article was published through the Canadian Environmental Network and is a survey of mountain bike management strategies at parks from Fernie, British Columbia, to Edson, Alberta. Respondents included protecting and land use agencies, as well as mountain bikers. Mosedale presents finding of issues by location, which are a description of partnerships and driving forces behind mountain biker management. The article cites some studies that indicate mountain bikes do not cause environmental stress, but acknowledges that the study did not conduct a Literature Review on that subject.

Management strategies employed to minimize user conflict include: closures and other restrictions, user group separation, education and information, trail use designation, communication, and volunteer patrols. Mosedale also notes that Parks Canada has changed its management strategy as a result of closing a trail to mountain biking without involving local mountain biking groups. He concludes by recommending regional collaboration for management of mountain biking, as use shifts regionally as a result of management decisions.

Keywords: Problem definition (manager and user survey), trail layout/availability, education, volunteer programs, user group meetings, user information

Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	○	Useful Information	◑		

E.4.12 Adoption of Negative Declaration and Policy Related to New Off Road Bicycle Trail in County Parks

Santa Clara County. 1989.

This proposed Negative Declaration for CEQA finds that the Santa Clara County Parks and Recreation Department Off-Road Bike Policy will not have a significant impact on the environment, based on studies conducted by the County. Published by the Public Services Agency of the Santa Clara County Parks and Recreation Department, the trail policy permits off-road bicycle uses in seven Santa Clara Parks. IMBA cites this article on their website.

The accompanying report enumerates the fiscal implications of the project, which include trail improvements and ongoing maintenance and operational costs. In addition, it cites two studies undertaken for the application. A survey of County park visitors identified user conflicts, while the other study considered the extent of erosion caused by mountain bikers. Proposed policy modifications include educating the public at each affected park, posting trail yield instruction signs at trailheads, increasing the trail patrol, advocating the use of volunteer trail patrols, citing violators of trail policy, designating trail closure when trail conditions present safety and/or environmental concerns, and ensuring that all designated trails conform to policy facility standards.

Where trails were considered too steep and/or narrow to accommodate multiple uses, the County recommends designating a one-way section and/or having mountain bikers walk, including posting signs and increasing patrols.

Keywords: Problem definition (user survey), education, volunteer programs, user information, rules and regulations, enforcement

Objectivity:	●	Applicability	◑	Sustainability:	●
Thoroughness	●	Useful Information	◑		

E.4.13 Trail Maintenance and Management: We Built it And They Came

Searns, R., B. Woodcock & J. Pflaum. 2007. National Trails Training Partnership.
www.americantrails.org/resources/ManageMaintain/ManageMCSearns.html

This short case study posted on the National Trails Training Partnership discusses physical measures undertaken to calm bicycle traffic and reduce safety issues and conflict between bicyclists and pedestrians on a popular regional trail south of Denver. It was co-authored by the Chair of American Trails (Searns), a civic engineer who designed side trail and roundabout (Pflaum), and the Manager of Planning and Development with the South Suburban Park and Recreation District in Littleton, Colorado (Woodcock).

The treatments discussed include a 15 miles per hour speed limit enforced with harsh penalties, centerline striping, a parallel pedestrian path, and bicycle roundabouts. At the time of the writings, the traffic calming impacts of the roundabouts was not clear.

Keywords: Speed control features, rules and regulations

Objectivity: ◑ Applicability ◑ Sustainability: ○

Thoroughness ○ Useful Information ◑

E.4.14 Santa Monica Mountains Area Recreational Trail Coordination Project

Santa Monica Mountains National Recreation Area. 1997.
http://www.nps.gov/samo/parkmgmt/smmartreportsept1997.htm

A cooperative effort of the Santa Monica Mountains Area Recreation Trails Coordination Project, this project was facilitated by the Rivers, Trails and Conservation Assistance Program of the National Park Service. The report is a summary of a collaborative effort to improve the trail system in and surrounding the Santa Monica Mountains National Recreation Area near Las Angeles, California. The report includes park and local officials as well as representatives from different park user groups. The purpose of the study is to collaboratively develop recommendations for issues confronting the Santa Monica Mountains area trails system including: developing standards for shared-use trails, improving signage throughout the area, and building support for the trails system through involvement with various local interest groups. Not only did this study make several positive recommendations for the trails, but it also built bridges between different user groups by assessing their desires and having them work together to achieve mutually beneficial goals and management strategies.

Some of the notable suggestions produced for trail guidelines were posting the maximum speed limits for bikers on shared-use trails and having regulations and trail etiquette well marked at trailheads. Also, the group determined that it is essential to have signs at the appropriate location and level for the group it is communicating information to. It was felt that the most signage and the widest, least vision-restricting trail design was needed at trailheads, as these areas had the greatest potential to experience safety issues. Safety issues are less likely further into the trail system, therefore reducing the need for safety precaution through design.

Shared-use trail guidelines for new trails were collectively developed by all participating user groups. One of the possible regulations for application to existing trails is that if an existing single-use trail meets 75 percent of the shared-use trail guidelines, it should be open to shared use. It is the intent that over time, any shared-use trail not complying with all the guidelines will be modified until it is brought up to 100 percent compliance.

This is a useful resource for both support and guidance of shared-use trail systems. It shows how a collaborative initiative can help address the needs of several user groups.

Keywords: Problem definition (manager survey), design guidelines, width/passing areas, design speed, sight lines, gradient, trail layout/availability, user group meetings, user information, enforcement, rules and regulations

Objectivity:	●	Applicability	●	Sustainability:	◑
Thoroughness	●	Useful Information	●		

E.5 Academic Studies

E.5.1 The Relationship Between Past Experience and Multiple Use Trail Conflict

Bradsher, D.J. 2003. North Carolina State University Masters' Thesis.
http://www.californiatrails.org/documents/RelationshipBetwConflict.pdf

Conducted under the direction of R.L. Moore (*Conflicts on Multiple-Use Trails*, 1994), this Master's Thesis tested the relationship between experience and conflict on shared-use natural surface trails. The research was conducted in the Greater Snow King Area of the Bridger-Teton National Forest near Jackson, Wyoming in 2002. Participants were asked to rate their increased or decreased enjoyment due to encounters with other user groups. Past experience was judged based on participants having participated in other activities on the trail.

The analysis found that users with past experience with running, mountain biking, horseback riding, and walking dogs experienced less conflict when encountering participants of those activities than respondents who had never done those activities before. People who had participated in an activity in the past were also more likely to report increased enjoyment due to encounters with that group than were trail users who had never done the activity before, although the relationship was not statistically significant between mountain biking and horse riding.

Bradsher notes that, conflict is not "an objective state, rather it is an individual's interpretation and evaluation of past and future social contacts." While the majority of trail users did not feel that encountering other user types affected their enjoyment, the study found some "reduced enjoyment" with runners, pedestrians/hikers, mountain bikers, and equestrians encountering another activity group. The greatest negative effect on enjoyment was attributed to equestrians (less than one-fifth of users feeling this way). In addition, all user groups indicated that encounters increased their enjoyment, in particular encounters with pedestrians/hikers and with dog walkers. Common reasons for increased enjoyment provided include "seeing other users' enjoyment" (runners, walkers/hikers, mountain bikers) and "pleasant/friendly encounters" (walkers/hikers). While on average, respondents felt that mountain bikers had a positive impact on enjoyment, almost half of comments indicated conflicts, particularly excessive speeding.

This research provides background into the causes of trail user conflicts and indicates that building partnerships and encouraging interactions between different users can minimize perceptions of conflicts.

Keywords: Problem definition (user survey), volunteer programs, user group meetings

Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.5.2 Social values versus interpersonal conflict among hikers and mountain bikers

Carothers, P., Vaske, J. J., and Donnelly, M. P. 2001. Leisure Sciences, 23(1), 47-61
http://bolt.lakeheadu.ca/~bpaynewww/3812/carothers.pdf

This article from *Leisure Sciences* evaluated hikers' and mountain bikers' normative beliefs about unacceptable social values as indicators of recreation conflict. IMBA cites this article on their website. Users were surveyed in the Jefferson County Open Space trail system west of Denver, Colorado.

The report draws a distinction between interpersonal conflicts (wherein one individual directly impacts another) and social value conflicts (independent of actual contact between the individuals). Survey responses were categorized into users who did not perceive or observe a problem; those who did not observe but perceived a problem ("social values conflict") and those who both observed and perceived a problem ("interpersonal conflict").

The study found that more conflicts were reported for mountain bicyclists than hikers. Most of the conflicts involving hikers were reported by mountain bicyclists. Mountain bicyclists, hikers, and people who participate in both activities all reported more interpersonal, rather than social value conflicts. The study concludes by recommending separation between mountain bicyclists and hikers, stating that, "When the conflict stems from interpersonal conflict, zoning incompatible users into different locations of the resource is an effective strategy." It also notes that increased law enforcement, expanded education programs, and the posting of signs could improve behavior, although the study does not discuss how or why these treatments might reduce user conflicts.

The study is a thorough analysis of user perceptions based on data collected. However, it does not provide substantial guidance for agencies seeking to minimize conflicts without space for user separation.

Keywords: Problem definition (user survey), trail layout/availability, education, user information, alternate use days

Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.3 Off-Road Impacts of Mountain Bikes: A Review and Discussion

Cessford, G.R. 1995b. Science and Research Series #92, New Zealand Department of Conservation.

Gordon Cessford is a Senior Social Scientist for the New Zealand Department of Conservation. His focus is research and information coordination in the recreation, tourism, and public relations sector of the department. He has a master's degree from Lincoln University in Resource Management and Outdoor Recreation Research. IMBA cites this article on their website.

This study summarizes and builds upon the information of the social and environmental impacts of mountain biking. The objectives are to provide a profile of mountain bike rider characteristics, to describe their preferences for recreation settings and experiences, to determine their attitudes toward key management issues, and to make recommendations for management options and future research needs. Cessford discusses the environmental impacts of various users on trails, which are not analyzed for the purposes of this Assessment.

Active mountain bikers were surveyed at two major mountain bike races in the Wellington Area of New Zealand. The top features respondents cited for mountain biking were speed/excitement/risk (43 percent), exercise/fitness workout (42 percent), and appreciating views/scenery (38 percent). Almost three-quarters prefer routes in native forestland over routes in forestry areas or in open farmland.

Cessford concludes that although conflict is possible in cases of irresponsible riding, experience and research shows that accidents are not common, based primarily on mountain bikers' perceptions that safety concerns are over-estimated. Negative perception of mountain biking from other users can stem from a general difference in values, desires, appearance, and age between mountain bikers and other trail users. Trail users not familiar with mountain biking may also perceive that mountain bikers should be confined to just a few trails or primitive roads, whereas in reality many mountain bikers seek out and enjoy the same trail variety and intimacy that hikers enjoy.

Cessford concludes by making several management suggestions based on the research. He states that on trails where speed is a legitimate safety issue, the addition of trail design elements such as steps, rocks, culverts, logs, water bars, can be used to slow or deter riders. He also suggests using programming techniques to restrict mountain biker access to trails where the potential for safety issues or user conflict with children, families, and elderly user groups is greater. Research also suggests that perceived conflict may decrease over time as different user groups become more familiar with one another.

Keywords: Problem definition (user survey), speed control features

Objectivity:	◑	Applicability	◑	Sustainability:	◑
Thoroughness	◑	Useful Information	◑		

E.5.4 Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand

Cessford, G.R. 2002. IMBA. http://www.imba.com/resources/research/trail-science/perception-and-reality-conflict-walkers-and-mountain-bikes-queen-charlotte

This 2002 article by Gordon Cessford was presented at the Monitoring and Management of Visitor Flows in Recreational and Protected Areas Conference in Vienna, Austria. IMBA cites this article on their website. The paper considers the social and physical impacts attributed to mountain biking. Cessford analyzed surveys from pedestrians on a soft-surface trail where biking was allowed on a trial basis.

Cessford discusses the three major categories of concerns with mountain biking: environmental impacts, perceptions of safety hazards, and perceptions of social impacts. He finds few reported incidents involving a bicyclist hitting a hiker, and concludes that actual safety hazards are likely over-estimated by walkers. The primary focus of the research is to determine if walking and biking have different experience preferences, ensuring that the activities would always be in conflict.

The survey found that the majority of walkers who encountered bikes on the track did not report themselves to be dissatisfied because of the experience. In fact, walkers who had not encountered any bicyclists had the most negative perceptions of bicyclists, followed by those who saw bicyclists but did not expect them to be present. Walkers over 40 were more likely to have negative perceptions of bicyclists. Cessford concludes that perceptions and realities of conflicts are different, and that increasing awareness and experience of sharing a track can reduce perceptions of problems.

The analysis of walkers' perceptions on the Queen Charlotte Track follows a user survey. However, Cessford's conclusion that mountain bikes do not cause safety hazards is founded on incident reports, which may not count all bicycle/pedestrian crashes if no hospitalization or property damage results. In addition, Cessford does not offer user conflict strategies other than increased exposure.

Keywords: Problem definition (user survey),

Objectivity: ◑ Applicability ◑ Sustainability: ○

Thoroughness ● Useful Information ◑

E.5.5 Mountain Biking: Direct, Indirect and Bridge-Building Management Styles

Chavez, D. J. 1996b. Journal of Park and Recreation Administration 14: 21-35.

Deborah Chavez is a Research Social Scientist with the USDA forest service, who has published several other articles included in this Literature Review, including *Recreational Mountain Biking: A Management Perspective* (1993, with Winter and Bass), *Mountain Biking: Issues and Actions for USDA Forest Service Managers* (1996), *Mountain Biking Management: Resource Protection and Social Conflict* (1997), and *Mountain Bicyclists' Behavior in Social Trail Etiquette Situations* (2000, with Hendricks and Ramthum). IMBA cites this article on their website.

This article revisits the results of the 1991 national survey of USDA Forest Service Regional Foresters (Tilmant, 1991 not published) with an updated survey in 1993. Survey questions included management issues and actions related to mountain bike use of National Forests, including whether mountain bikers are a management concerns, the frequency of accidents, resource damage, user conflict, or safety problems, and how these were addressed.

The results from the second set of surveys indicated that managers are increasingly looking to 'bridge building' activities to address or mitigate conflicts. These strategies are different from the direct, indirect, or resource hardening classifications that emerged in the previous survey. Chavez describes bridge building techniques as involving "two-way or multi-way communication, cooperation, and resource sharing between individuals or groups and agencies." Examples of techniques include personal contacts with users and partnering with different groups.

Seventy percent of forest managers reported that they had observed or received reports of user conflict. The most frequently reported conflict was between mountain bikers and hikers (37 percent), followed by mountain bikers and equestrians (34 percent). The majority of techniques used to reduce user conflicts were indirect, including posters/signs, brochures, and etiquette). The majority of forest managers (59 percent) reported that they had observed or received safety problems related to mountain bike use. These included excessive speeding, lack of noise, careless mountain bikers, and pack animal safety concerns. Solutions included indirect strategies similar to those used to address user conflicts. Almost half of forest managers (48 percent) had observed mountain bike accidents. Most of the solutions were indirect, as well as direct management (including separating uses), and bridge building.

Keywords: Problem definition (manager survey), education, user group meeting

Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.6 Recreational Mountain Biking: A Management Perspective

Chavez, D. J., P.L. Winter, and J.M. Baas. 1993. Journal of Park and Recreational Administration. 11:3. 29-36.

Two of the researchers for this project are research social scientists for the Wildland Recreation and Urban Culture Project, USDA Forest Service, pacific Southwest Research Station (Chavez and Winter), while the third is a human dimensions in wildlife management specialist with the Colorado Division of Wildlife and is a professor at Colorado State University (Baas). IMBA cites this article on their website. The study involved telephone surveys of 40 recreational managers from the USDA Forest Service and USDI Bureau of Land Management regarding management practiced for mountain biking. Researchers asked four yes or no questions about mountain bike use and perceived issues.

The jurisdictions interviewed characterized biking in their region as moderate to extensive. Over half of interviewees reported conflicts between bikers and other user groups. Conflicts included equestrians, hikers, ORV/ATV, and wilderness trespass. Only one interviewee reported an incident that had resulted in injury and litigation, while the majority of complaints were related to “turf,” or users feeling that new users were usurping the trails. Some of the managers reported success in encouraging councils or user groups to resolve the issues together. “Categories of concern” included mangers desiring a way of handling multiple use, need for signs, maps, and brochures, and ways of encouraging user group cooperation.

Keywords: Problem definition (manager survey)

Objectivity:	◑	Applicability	●	Sustainability:	◑
Thoroughness	◑	Useful Information	◑		

E.5.7 Comparing the Effectiveness of Interpretive and Sanction Messages for Influencing Wilderness Visitors' Intended Behavior

Duncan, G., and S. Martin. 2002. International Journal of Wilderness 8: 20-25. http://ijw.org/wp-content/uploads/2002/08/Vol-08.No-2.Aug-02small.pdf

For this research, trail users viewed either sanction, interpretation, or no (control group) signs, and then were asked to indicate the likelihood they would perform certain behaviors in given scenarios. Behaviors included firewood collection, human waste disposal, cultural artifacts, and food scraps disposal. The laboratory experiment indicated that the interpretation message was as effective as the sanction in three of the four scenarios, and both types were more effective than no message.

The background provides information about many studies that have indicated how providing the reason for a regulation is usually more effective than stating the rule, for a variety of park management scenarios. However, there is a concern that threatening users with sanctions diminishes the wilderness experience. The study found that for one of the undesired behaviors (wood gathering), interpretation signs were more effective than sanctions, and they were at least as effective for all scenarios. The study evaluated reported resource management behavior, which may deviate from actual behaviors. It is unclear to what extent this study would translate to yielding behavior on trails, but it does indicate that users respond to signs.

Keywords: User information

Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.8 Mountain Bikes and the Parks: Mitigation of Safety and User Conflict Problems

Goldstein, S. S. 1987. Unpublished undergraduate paper, UC Santa Cruz.

This thesis was submitted for a Bachelor of Arts in Environmental Studies at the University of California, Santa Cruz. Goldstein interned for the Santa Cruz Mountains District of State Parks and discusses the Nisene Marks State Park. He investigates the safety concerns and social conflicts involving mountain bikers and specifically does not consider physical impacts of mountain bikes. IMBA cites this article on their website.

Goldstein presents a brief Literature Review, followed by a discussion of methods for reducing user conflicts and safety concerns. He recommends "a comprehensive and well-designed outreach campaign by the parks, in conjunction with cycling manufacturers, retailers and clubs." He also recommends that willing and interested trail users educate users and encourage proper behavior. A "Wilderness Area Hosts" or cycling assistance program could involve hikers or mountain bikers in education, enforcement, and rescue activities.

Design measures include improving line-of-sight, upgrading for impact resistance, and other treatments. The recommendation for using water balls as speed bumps does not provide specific dimensions. Stiles can be used to force cyclists to slow down. Goldstein cites a personal interview with George Geer, a Sunset Unit Rangers with the Arroyo Seco Ranger District in Angeles National Forest, who recommends that the notch to be the width of the average set of bicycle cranks, plus 2 or 3 inches. Stiles cannot be used where wheelchair access is an issue. Several of these mitigation measures do not include specific dimensions or guidance, and others do not contain any references.

Keywords: Problem definition (theoretical), design guidelines, speed control measures, sight lines, education, volunteer programs, events, user group meetings, enforcement

Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	●		

E.5.9 The Effects of Persuasive Message Source and Content on Mountain Bicyclists' Adherence to Trail Etiquette Guidelines

Hendricks, W., R. H. Ramthun, and D. J. Chavez. 2001. Journal of Park and Recreation Administration 19(3): 38-61.

This study was co-authored by a professor with the Recreation Administration Program, Natural Resources Management Department at California Polytechnic State University (Hendricks), a profession with Tourism Industry Management at Concord College (Ramthun), and a research social scientist with the USDA Forest Service (Chavez). IMBA cites this article on their website.

The study was conducted in the Marin Municipal Water District (MMWD), on fire roads on Mt. Tamalpais where bicycling is allowed. At the time of the study, MMWD enforced a 15 mph speed limit on all trails and a 5 mph speed limit when passing others and on blind curves. The fine for speeding was $200, while the fine for riding on single-track where bicycling is prohibited was $125. The study tested three main factors: bicyclists' behaviors, message content, and message source as shown in Table E-7.

Table E-7. Matrix of Variables Tested, Hendricks et. al., 2001

Behaviors Tested[i]	Message Content Tested	Message Sources Testes
• Bicyclists' yielding behavior when approaching hikers • Bikers' speeds • Bikers' actions when approaching an area where biking was prohibited • Bikers' behavior at stream crossings	• 'Moral appeals' to protect the natural resources and enhance other users' safety • 'Fear appeals' that identified consequences.	• Uniformed agency volunteer • Hiker • Biker

[i]*Yielding was rated on a 10-point scale by trained researchers, speed was tested with a hidden radar gun, and behaviors categorized into 'compliance' and 'non-compliance'*

For yielding behavior, the study found that the appeal source did not make a difference, but the fear appeal resulted in stronger yielding behavior than the moral appeal or the control. On the other hand, neither message source nor content had a significant impact on bicyclists' speeds. Bikers given an appeal message from a volunteer hiker were found to be more likely to dismount when approaching an area where bicycling was prohibited (although compliance remained below 40 percent in all cases), while the fear appeal was more likely to result in bikers dismounting to cross the stream. In all four behaviors, the uniformed volunteer was less effective in gaining compliance than the volunteer biker or hiker.

The authors make the conclusions that any type of message is better than no message at all. In addition, they postulate that, because bikers were not aware their speeds were being measured, they had less incentive to comply with regulations given a threat of the consequences. The authors conclude that, "volunteer mountain bike patrols, such as those organized and trained by IMBA's National Mountain Bike Patrol, have the potential to be an effective mechanism for influencing behavior of bicyclists."

Keywords: Problem definition (user survey), education, volunteer programs, user information

Objectivity: ● Applicability ● Sustainability: ○

Thoroughness ● Useful Information ●

E.5.10 Conflict and Management Tactics on the Trail

Hoger, J. L. and Deborah J. C. 1998. Parks & Recreation, 33(9), 41-49.
http://admin.ibt.org.il/files/94644644798.pdf

This article is a Literature Review summarizing common concerns about mountain biking on shared trails, including environmental impact, trail degradation, trail safety, and social differences. The document presents a brief history of mountain biking, as well as previously-identified sources of conflict. In particular, the article focuses on the perception of conflict among mountain bikers, hikers and equestrians. It also summarizes different management techniques, including indirect and direct management, education, and outreach. The authors cite several studies in their evaluation of the conflict and the available tools for managers.

Keywords: Problem definition (theoretical), education, user information

Objectivity: ● Applicability ● Sustainability: ◑

Thoroughness ◑ Useful Information ○

E.5.11 Conflicts and Issues Related to Mountain Biking in the National Forests: A Multimethodological Approach

Hollenhorst, S. J., Schuett, M. A., Olson, D. 1995. USDA Forest Service Gen. Tech. Rep. PSW-156.
http://www.fs.fed.us/psw/publications/documents/psw_gtr156/psw_gtr156_1_hollenhorst.pdf

This article was written for the U.S. Forest Service by a professor of Wildlands Recreation, Division of Forestry at West Virginia University (Hollenhorst), a professor of Recreation Administration, Department of Health, Physical Education and Recreation at Southwest Texas State University (Schuett), and a Recreation Research Technician in the Division of Forestry at West Virginia University (Olson). The study was conducted to understand issues and management solutions to high participation rates of mountain bikers on National Forest land. This is a shorter analysis of the same data analyzed in *An Examination of the Characteristics, Preferences, and Attitudes of Mountain Bike Users of the National Forests* (Hollenhorst, Schuett, Olson, & Chavez, 1993). IMBA cites this article on their website.

Mountain bikers were surveyed in four locations in National Forests nationwide. Three focus groups were also held in Houston and Austin Texas and in Morgantown, West Virginia. The survey results indicate that mountain bikers are concerned with conflict and the impact increasing mountain biking may have on their future access to trails. The mountain bikers surveyed also indicated a perception that equestrians and pedestrians are too “possessive” of trails and intolerant of mountain bikers, though mountain bikers are relatively tolerant of other users.

The authors state that, while the management strategy of providing separate trails for different users was discussed, it “was not regarded as a plausible solution by any of the participants.” Participants were supportive of informational signs and suggested that mountain bike manufacturers and retailers could take a part in educating users.

Keywords: Problem definition (user survey), trail layout/availability

Objectivity: ● Applicability ● Sustainability: ◑

Thoroughness ◑ Useful Information ◑

E.5.12 Resolving inter-group conflict in winter recreation: Chilkoot Trail National Historic Site, British Columbia

Jackson, S. A., Haider, W., & Elliot, T 2004. Journal for Nature Conservation, 11(4): 317-323. ***http://www.collectionscanada.gc.ca/obj/s4/f2/dsk3/ftp04/MQ61568.pdf***

This study conducted through the University of Victoria evaluates the effectiveness of separating snowmobilers and skiers in reducing user conflict. The research surveyed users to gauge satisfaction with a management strategy that excludes snowmobilers every third weekend. Surveys were conducted in 1993 and 1998 to compare perceptions of recreation conflict.

The survey asked about visitor motivations for visiting the area, and results indicate that snowmobilers and skiers exhibit different perceptions of conflicts with other users, motivations to use the trail, and values in outdoor recreation. The survey then asked users about their perceptions of whether their goals had been achieved.

It also shows that an exclusionary management strategy can effectively increase the skiers' satisfaction and reduce snowmobilers' satisfaction. It demonstrates the possible results of using direct management strategies to separate trail users. While the article does not specifically address trail user types relevant to most California State Parks' experience, the study outlines how management strategies can successfully negotiate and reduce user conflicts.

Keywords: Problem definition (user survey), alternate use days

Objectivity: ◑ Applicability ◑ Sustainability: ○

Thoroughness ● Useful Information ●

E.5.13 Conflict in Outdoor Recreation: A Theoretical Perspective

Jacob, G.R. and R. Schreyer. 1980. Journal of Leisure Research 4: 368-379.

This article was co-authored by a consultant (Jacob) and a professor in the Department of Forestry and Outdoor Recreation at Utah State University (Schreyer). One of the first academic studies of conflicts in outdoor restoration, the study defines conflict as goal interference as a result of others' behaviors and discusses the phenomenon of scapegoating, wherein feelings of frustration are attributed to a different source.

The authors propose four factors which contribute to this conflict:

- "Activity style – the various personal meanings assigned to an activity
- Resource specificity – the significance attached to using a specific recreation resource for a given recreational experience
- Mode of experience – the varying expectations of how the natural environment will be perceived
- Lifestyle tolerance – the tendency to accept or reject lifestyles different from ones' own"

These four factors do not necessitate actual conflict; rather, "the degree to which these factors are present represents the extent to which the *potential* for conflict exists."

While the theoretical framework proposed in this article has been superseded by more recent academic work, this article is one of the first to attempt to define a theory about conflict in outdoor recreation.

Keywords:	Problem definition (theoretical)				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.14 Managing Mountain Bike Recreation and User Conflicts: A Case Study on Mt. Baker-Snoqualmie National Forest, Washington State

Jellum, C. M. Research thesis, Central Washington University. 2007.

This research thesis was presented to Central Washington University for a Master of Science in Resource Management degree. It evaluates the effectiveness of biker/hiker policy for the Middle Fork Trail in the Snoqualmie National Forest on Mt. Baker in Washington State. To mitigate hiker/biker conflicts, trail managers adopted a temporal separation policy, allowing bike access every other day. An on-site exist questionnaire was presented to users to gauge perceptions.

Users were asked about perceptions of trail conditions and facilities, including width and information, and observed user-induced trail conditions (mud, manure, tire ruts, etc.). About half of hikers surveyed had positive perceptions of trail width on days mountain bikers were prohibited, which dropped to one-third on days that bikers are present, although overall the majority of hikers had positive responses.

For perceptions of user conflict, over 90 percent of bikers and hikers reported enjoyment and positive interactions with other users. Concerns included biker etiquette and speed. The majority of hikers (56 percent) and mountain bikers (83 percent) indicated liking the every-other-day policy. This highly positive response from mountain bikers may be attributed in part to the following question, which asks whether the trail should be closed to mountain bikes. About a quarter of hikers desired closing the trails to mountain bikers entirely, while over half felt they should not be closed (58 percent). By contrast, less than an eighth of hikers felt the trails should always be open to mountain bikers (11 percent), while slightly more than half of mountain bikers agreed (53 percent).

The study concludes with a recommendation to keep the current access policy. Additional restrictions for conflict reduction considered include closing the trail to cyclists after the first six miles. Physical recommendations for safety include hardening trail surfaces, increasing the width of the trail corridor (minimum of 24 inches), reducing the width of the trail to reduce speeds, strategically introducing user friendly barriers to reduce speed, and the realignment of trails/introduction of switchbacks at excessively steep slopes (other specific guidelines are not provided). Annual maintenance to reduce erosion, mud and other unpleasant trail conditions is also recommended as a measure to reduce conflict. Finally, the research recommends outreach to reduce user conflict and promote trail etiquette, such as signs and posters that detail restrictions /proper etiquette, patrolling, and partnership with local hiking and biking groups.

Keywords: Problem definition (user survey), design guidelines, width/passing areas, speed control measures, gradient, education, user group meetings, user information

Objectivity: ● Applicability ● Sustainability: ○
Thoroughness ● Useful Information ●

E.5.15 Recreational Trail Conflict: Achieving Equity Through Diversity

Koontz, C. R. 2005. Masters' Thesis, Master of Science in Recreation Management, University of Montana.

This masters' thesis discusses the nature of conflicts on shared-use trails based on mode of travel and mode of experience. Koontz also promotes public involvement as critical for managing conflict, and discusses how managers can communicate plans and their rationales to visitors to increase efficacy. Koontz discusses the Recreation Opportunity Spectrum (ROS) framework that can be used to determine allocation of trails, although he is critical of it, stating that is favors the status quo.

The second chapter of the thesis makes a case for public involvement in trail planning. Koontz primarily cites other studies, and concludes the chapter with a case study of public involvement in Grant County, Utah. The majority of this research is theoretical in nature and does not provide specific guidelines or recommendations beyond public involvement.

Keywords: Problem definition (theoretical), user group notification, user group meetings, public notification

Objectivity: ◑ Applicability ◑ Sustainability: ○
Thoroughness ◑ Useful Information ◑

E.5.16 Congestion and Crowding in the National Park System: Guidelines for Management and Research

Lime, D. (editor). 1996. St. Paul: University of Minnesota Agriculture Experiment Station Publication 86-1996.

This book was developed as a result of a 1993 workshop attended by National Park Service (NPS) employees and research cooperative and is an extension of research by University of Minnestoa's Cooperative Park Studies Unit. The book contains a series of articles about congestion and crowding, addressing concerns about NPS's role in environmental education, visitor education, managing conflicts (particularly with 'incompatible uses' such as ATV's and snowmobiles as well as generally), and addressing inappropriate behaviors within parks. Much of the research is associated with the NPS's Visitor Experience and Resource Protection (VERP) process (see Manning, 2007). The relevant articles are summarized below.

Congestion and Crowding at Parks and Related Areas: Narrowing the Gap Between What Is and is *Not* Known. Lime, D.

Lime defines congestion as "the physical conditions that occur during periods of high density use when infrastructures and services are seriously stressed" as compared to crowding, which is "a concept in which the number or type of people encountered exceeds an individuals' normative standards for a preferred experience." While these studies primarily pertain to backcountry camping management, the acceptance and efficacy of management strategies indicates strategies that may be successful for managing user conflicts on trails. For example, Lime found that park and recreation visitors have limited willingness to shift activity patterns to off-peak times to avoid congestion and crowding. In addition, locations that have few or no substitutes (e.g., Niagara Falls, the Grand Canyon, etc.) become particularly congested with few alternatives.

Strategies employed to manage congestion and crowding include reservations, limitation of entry, fees, visitor education/information, and visitor demonstration of skills/ knowledge. Lime stresses the importance of public involvement in determining the appropriate strategy for a particular park.

Crowding and Carrying Capacity in the National Park System: Toward a Social Science Research Agenda Manning, R.E., and Lime, D.

Manning and Lime discuss the difficulty of evaluating crowding, noting that "in most empirical studies, little or no statistical relationship was found between the level of visitor use and overall trip satisfaction." Crowding is a subjective measure of personal characteristics of visitors, characteristics of other visitors encountered, and situational variables (including level of development of the surrounding environment and perceived environmental quality of the park). They also define 'social carrying capacity' that deals with crowding and social impacts of visitor use, based on user perception studies.

Alleviating Congestion in Parks and Recreation Areas Through Direct Management of Visitor Behavior McCool, S.F. and Christensen, N.A.

This study compares direct and indirect management styles for managing congestion in National Parks. Direct management styles rely on regulation of behavior through sanctions or fines, while indirect styles include information and education. The authors note that, "by retaining the locus of control within the visitor, indirect measures provide a context within which the visitor retains the sense of freedom important to recreation experiences." In addition, most user studies show a preference for indirect management.

The authors provide research to date on specific management strategies, including seasonal/temporal limit on use level, group type restrictions, and area closures, among others. They found that visitors accept use limit policies if they feel that the resource requires the protection afforded by the policy. They note that use restrictions on bicycling can be controversial.

The authors conclude that:

- Visitor support for direct management is highest when the rationale is understood and the benefits of such techniques can be easily understood.
- Visitor support for direct management is highest in settings with a tradition of direct management, and techniques with which they are familiar.
- Preferences and acceptability of direct management are influenced by visitor motivations for visiting the setting.

Keywords: Problem definition (theoretical, user surveys), education, alternate use days,, rules and regulations,

Objectivity:	◑	Applicability	◑	Sustainability:	◑
Thoroughness	◑	Useful Information	◑		

E.5.17 Indentifying and Monitoring Indicators of Visitor Experience and Resource Quality: A Handbook for Recreation Resource Managers

Lime, D., D. Anderson, and J. Thompson. 2004. St. Paul: University of Minnesota Department of Forest Resources. cpsp.cfans.umn.edu/publications/Indicators_Standards_Handbook.pdf

Prepared by the University of Minnesota Department of Forest Resources and funded by the Minnesota Department of Natural Resources' Division of Parks and Recreation, this handbook is designed to assist managers in identifying and mitigating problems in Minnesota parks. It is intended to accompany the previous guide: *Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers* (Anderson et al., 1998), which addresses impacts of biophysical resources and visitor experiences. This guide presents indicators of quality and the monitoring of indicator variables and focuses on preventing impacts from reaching unacceptable levels or exceeding carrying capacity.

The guide defines carrying capacity as, "The amount and type of use that can be accommodated in a particular area over time while sustaining desired biophysical resources and opportunities for quality visitor experiences." Carrying capacity is measured by minimally acceptable conditions (MACs) or standards of quality, which "are increasingly explicit statements of management objectives and reflect the quantitative and measurable conditions of indicator variables." Indicator variables are selected for a particular park, and should be: specific, objective and measurable, reliable and repeatable, sensitive, related to visitor use, efficient and effective to measure, and significant. In addition, a quantifiable measure of the indicators must be determined, with a threshold to determine when action is required.

The guide addresses how to evaluate concerns about impacts to resources (e.g., vegetation) and social conflicts (e.g., carrying capacity as measured by persons at one time [PAOT] and number of users encountered).However, no specific indicators of user safety or conflicts between different user groups on trails are defined. Methods for data collection include roadway level of service on access roads, visitor surveys.

Keywords:	Problem definition (theoretical)				
Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

Mountain Bikes and Metropolitan Park Districts: Issues and Trends Indentified by State Parks and State Park Districts in Ohio

Longsdorf, E. L. 2006. Proceedings of the 2006 Northeastern Recreation Research Symposium, GTR-NRS-P-14. http://www.americantrails.org/resources/ManageMaintain/OhioMtnbike.html

This study publishes the result of a survey sent to Ohio State Parks and Park Districts about mountain biking and mountain bike management. The survey results indicate that the increase in mountain bike use of trails in State Parks poses new challenges for resource management, and that State Park managers are concerned about the social and ecological impacts related to recreational use of mountain bike, including environmental damage, user conflicts, accidents and safety.

The study suggests that park managers have several strategies available to manage mountain bikers, including behavior modification (both direct and indirect), resource hardening, and building bridges between user groups. This survey indicates that Ohio State Parks are employing mostly indirect behavior modification and bridge-building. This article does not address the attitude or preferences of mountain bikers, or their perception of management efforts. Though it does not discuss conflicts between user groups at length, it does report incidents of conflict (shown in Table E-8), and addresses issues on shared trails and exclusion of cyclists from certain trails.

Table E-8. Reported Trends in Mountain Bike Management in Ohio State Parks and State Park Districts (Longsdorf, 2006)

Table 5.—Reported Trends in Mountain Bike Management in Ohio State Parks

Management Indicator	Yes	Percentage	No	Percentage
Observed Evidence or Resource Damage From Mountain Biking	6	33	12	67
Observed/Received Reports of Mountain Biking Accidents	7	39	11	61
Observed/Received Reports of User Conflict from Mountain Biking	7	39	11	61
Observed/Received Reports of MTB Safety Problems	4	22	14	78

N=18

Table 6.—Reported Trends in Mountain Bike Management in Ohio State Park Districts

Management Indicator	Yes	Percentage	No	Percentage
Observed Evidence or Resource Damage From Mountain Biking	3	38	5	62
Observed/Received Reports of Mountain Biking Accidents	1	13	7	87
Observed/Received Reports of User Conflict from Mountain Biking	2	25	6	75
Observed/Received Reports of MTB Safety Problems	0	0	8	100

N=8

This data demonstrates how resource damage, accidents, and user conflict are greater management concerns than safety issues due to conflicts with mountain bikers.

Keywords: Problem definition (manager survey)

Objectivity: ◑ Applicability ● Sustainability: ○

Thoroughness ◑ Useful Information ◑

E.5.18 Emerging Principles for Using Information/Education in Wilderness Management

Manning, R. 2003. International Journal of Wilderness 9: 20-27, 12. http://ijw.org/wp-content/uploads/2003/12/Vol-09.No-1.Apr-03small.pdf

Manning is a professor of Natural Resources and Director of the Park Studies Lab at the University of Vermont. He worked with the Park Service and has authored several publications on the subject of trail use, including *Parks and Carrying Capacity: Commons without Tragedy*. Published in the International Journal of Wilderness, this is peer-reviewed article.

This article is a conceptual review of literature that suggests the potential effectiveness of information and education on five types of problem behaviors of wilderness visitors (illegal, careless, unskilled, uninformed, and unavoidable actions).

Manning found that information and education has limited effectiveness in deterring deliberately illegal or unavoidable problem behaviors, while it can be effective at reducing careless, unskilled, or uninformed actions. This conclusion supports this Study's recommendation to address user conflict through a variety of avenues, including information, enforcement, and outreach.

The article defines several empirical studies that have analyzed the effectiveness of information and education programs. Studies that have focused on enhancing visitor knowledge to reduce ecological and social impacts have not found trailhead signs and brochures to be very effective, while workshops and special programs can enhance knowledge levels. Studies focusing on visitor attitudes toward management policies have found that information/education "can be effective in modifying visitor attitudes so they are more supportive of wilderness and related land management policies." Finally, studies focused on depreciative behavior (such as littering or vandalism) have found that education (a brochure and a personal contact) can be a successful deterrent to littering. While not directly related to user conflict, this finding supports the use of signs to encourage good user behaviors in a variety of contexts.

- Manning concludes with a series of 'emerging principles' for information and education programs, as paraphrased in the table below

Keywords: User information

Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.5.19 Parks and Carrying Capacity: Commons Without Tragedy

Manning, R. E. 2007. Washington, DC: Island Press.

In this book, Manning presents the development and methodology for developing the *Visitor Experience and Resource Protection* (VERP) program for the National Park Service. Also discussed in Anderson, Lime, and Wang (1998), VERP uses visitor perceptions to define indicators of carrying capacity for parks.

Indicators can include normative standards of how acceptable certain conditions are, and Manning provides a methodology to determine a social norm curve for a group, based on surveys or preference tests. The majority of indicators discussed are related to persons-at-a-time at key locations within a park setting, as well as trash or environmental indicators of use, rather than physical incidents or conflicts.

While VERP is primarily intended to guide management decisions about number of hikers or campers in a wilderness setting, some of the guidance could be used for trail user conflicts. For example, Manning recognizes the encounters with a specific type of user may have a greater impact on perceived crowding than another user.

One relevant case study is that of crowding on carriage roads in at Arcadia National Park, Maine. One of the indicators that emerged from the study addressed "problem behaviors" such as bicyclists passing without warning, excessive bicycle speed, people obstructing the road by walking abreast, and off-leash dogs. The study found that most visitors supported a mix of users, indicating a management strategy of establishing zones. However, the empirical methodology used a crowding measure of persons-per-viewpoint (PPV) based on a visual measurement approach.

Manning's recommendations for management strategies include education, including workshops and brochures (including key recommendations from Manning, 2003) and use-rationing, in which he recommends implementing use quotas and controlling access.

Manning does not explore actual incidence of density, crowding or conflict experienced by park users, but their preference for different photographic representations. The study also does not differentiate between distinct, conflicting user groups, such as cyclists and pedestrians.

Keywords:	Problem definition,(user survey), user group meetings, alternate use days, user information				
Objectivity:	●	Applicability	◑	Sustainability:	◑
Thoroughness	◑	Useful Information	◑		

E.5.20 The Effects of Activity Differences on Recreation Experiences Along a Suburban Greenway Trail

Moore, R. L., D. Scott and A. R. Graefe. 1998. Journal of Park and Recreation Administration 16(2), 35-53.

This article was co-authored by a professor in the Department of Parks, Recreation, and Tourism Management at North Carolina State University (Moore), a professor in the Department of Parks, Recreation, and Tourism Sciences at Texas A & M University (Scott), and a professor in the Leisure Studies Program at Pennsylvania State University (Grafe).

The authors sampled 438 walkers, runners, in-line skaters, and bicyclists on a paved trail in North Chagrin Reservation near Cleveland, Ohio to "explore the effects of each activity upon the experiences of those engaged in the others." They suggest that Jacob and Schreyer's (1980) theory about four classes of factors that influence user conflict (activity style, resource specificity, mode of experience, and tolerance for lifestyle diversity) are more useful for predicting predispositions toward conflict than actual goal interference.

While this study focused on experiences between users on paved trails, the findings are nonetheless relevant to interactions on soft-surface trails. While most of the problems and concerns users have are minor, a small minority of users expressed significant issues with other users. In general, users reported feeling more positive about sharing the trail with other users engaged in the same activity. Frequent problems included walkers and runners traveling two or more abreast and not moving aside for others to pass. Complaints about bikers and in-line skaters were that they were traveling too fast and failing to provide a warning when passing other users. The authors conclude that "conflict does not appear to be a major problem overall," but a sizable minority may experience major problems.

Keywords:	Problem definition (user survey)				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	○		

E.5.21 Estimating the benefits and costs to mountain bikers of changes in trail characteristics, access fees, and site closures: choice experiments and benefits transfer

Morey, E. R., T. Buchanan and D. M. Waldman. 2002. Journal of Environmental Management (2002) 64, 411–422.

Written by professors in the Department of Economics at the University of Colorado, Boulder, this study looks at costs of different management strategies for mountain bikers. The study includes a brief background of management strategies in use and being considered, including limiting mountain bikers to fire roads and implementing access fees. The analysis uses a discrete choice random utility model of mountain bike site choice. Interviews and focus groups were conducted to evaluate which factors would cause mountain bikers to change sites.

The model indicated that the presence of hikers and equestrians had a significantly negative impact on site choice. Attractive features included presence of single-track and rolling hills (of a sufficient height).While increased access fee had a generally negative impact on site choice, depending on income, the results suggest that "significant numbers of bikers would be willing to pay an access fee for improved conditions," depending on number of substitute sites and trail characteristics.

Keywords:	Problem definition (user survey), trail layout/availability				
Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.22 Off the Road: The Issues Surrounding Mountain Bicycling

Morioka, Steven in Sloan, D. and T. Fletcher, Ed. 1989. In Environmental Management for the East Bay. Report of the Environmental Sciences Senior Seminar, University of California, Berkeley.

This document was written by an Environmental Studies class in the College of Letters and Sciences at UC Berkeley. The editors, Doris Sloan and Tod Fletcher, were the Senior Seminar instructors. IMBA cites this article on their website. The chapter on mountain biking discusses issues identified by park users in Charles Tilden Regional Park. Environmental impacts were assessed through a Literature Review. Research on safety issues and conflicts included informal interviews, attendance at trail user meetings, and attending hearings held by the California Recreational Trails Committee.

The article notes that four of the 24 cycling accidents reported at the East Bay Regional Park District (EBRPD) from July 1987 to June 1988 involved a cyclist and another user; two cases involved two bicyclists colliding, one involved a cyclist falling when avoiding a cow, and the final involved a cyclist falling to avoid a hiker. The specific recommendations for managing safety and user conflict (educational efforts, stricter regulations, design improvements) do not directly follow the data collected.

Keywords:	Problem definition (incident data)				
Objectivity:	○	Applicability	◑	Sustainability:	●
Thoroughness	◑	Useful Information	○		

E.5.23 Conflict as a Social Interaction Process in Environment and Behavior Research: The Example of Leisure and Recreation Research

Owens, P.L. 1985. Journal of Environmental Psychology 5: 243-259

This article was published by a professor in the Department of Geography in the University of Sheffield, England. Owens presents a theory to distinguish between density, crowding and conflict in recreation. While *density* is a neutral descriptor, he describes *crowding* as a negative, subjective perception that results in a coping response to “eliminate discrepancies between achieved and desired states.” *Conflict*, the author posits, arises when feelings of crowding “metamorphose and eventually crystallize into conflict.” While crowding describes a transient state, feelings of conflict are cumulative and persistent. The author suggests implications of this theory for future management and empirical research. This concept of users vying for a limited resource is a precursor to the commonly-accepted concept that conflict is a result of goal interference.

Keywords:	Problem definition (theoretical)				
Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.24 Mountain Biking on the Niagara Escarpment

Pearce, B.1990. University of Waterloo Faculty of Environmental Studies School of Urban and Regional Planning.

This study discusses a survey of land managers and public-interest groups in the Niagara Escarpment area. It considers natural resource management and user conflicts. IMBA cites this article on their website. The section addressing user conflicts includes a brief synopsis of the problem. It contains no citations and makes several statements that conflate all hikers in having particular opinions and experiences with regard to mountain bikers. Presumably, these conclusions are based on the author’s personal experience.

The policies of the Escarpment Natural Area allow mountain biking as a “non-intensive” use. Managers responding to the survey concluded that mountain biking has not become an important planning issue, while public-interest groups are more divided. Few policies address mountain bikes in the area.

Recommendations for managing mountain biking include promoting ‘soft cycling’ or riding at lower speeds to reduce environmental impacts (based on IMBA’s *Rules of the Trail*). In addition, user groups can assist with trail maintenance and patrolling the park. This resource does not provide additional specific information about strategies to address user conflict.

Keywords:	Problem definition (manager survey)				
Objectivity:	◑	Applicability	◑	Sustainability:	●
Thoroughness	◑	Useful Information	○		

E.5.25 State Park Directors' Perceptions of Mountain Biking

Schuett, M. A. 1997. Environmental Management 21(2): 239-246.

Michael Schuett is an Assistant Professor at Southwest Texas State University in the department of Health, Physical Education, and Recreation. He has produced several studies focusing on many different areas of recreation and resource management. IMBA cites this article on their website.

This study summarizes and draws conclusions from a survey of the State Park Directors of all 50 states on the issue of mountain bike use within their respective state parks. While 89 percent of managers indicated that mountain biking was allowed in some areas of their state park system, 80 percent indicated that there is currently no management plan in place for mountain biking in their state. On average, only 40 percent of trails are open to mountain bikers. Approximately half the states reported minimal mountain bike trail use while the other half reported moderate use. Sixty-seven percent of park managers reported degradation problems due to mountain bike activity, but only 12 percent had conducted studies on degradation of trails in their respective parks. Seventy-seven percent of the states reported user conflict, the majority (80 percent) being between bikers and equestrians as opposed to hikers and bikers.

Schuett draws several conclusions and recommendations from the data. He suggests that states reporting moderate mountain bike use should consider a mountain bike management plan, while states reporting minimum use should consistently monitor trail use by mountain bikers to ensure that they are meeting the needs of all trail users. States with management plans in place have historically had little collaboration with local and regional bike groups on management strategies. Schuett suggests that these states should consider more involvement of mountain bike groups on management plans in the future. Lastly, Schuett recommends an internet database for park manager collaboration on management issues pertaining to mountain biking.

While the data presented in this case has some interesting implications, the recommendations are not directly drawn from the data presented. The main purpose of the paper is to establish possible areas of further study. It does indicate the need for more mountain bike management plans in the state parks and the possible misconception of the high environmental impact of mountain biking.

Keywords: Problem definition (manager survey), user group notification, user group meeting, public notification

Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.26 Goal Interference and Social Value Differences: Understanding Wilderness Conflicts and Implications for Managing Social Density

Watson, A. E.2001. USDA Forest Service Proceedings RMRSP-20: 62-67.

Watson is a Research Social Scientist with the Aldo Leopold Wilderness Research Institute of the USDA. In this article, he reviews theories about conflict between user groups, observing that perceptions of conflict are frequently unrelated to measurable incidents of interference in outdoor recreation, but rather reflect an attitude towards wilderness and stereotypes of other user groups. Watson notes that an interpersonal recreation conflict model proposed in the late 1970's set the tone for most wilderness conflict research in the U.S. While this methodology “may contribute to an understanding of how social densities influence perceptions of conflict," Watson argues that, "understanding of the causes for differences in attitudes toward wilderness and the meanings various subpopulations attribute to wilderness resources will be critical to developing solutions for conflict management and managing the social mix among all demands in the future."

Watson criticizes modern conflict literature for discounting the interaction between the number of people, their behaviors, and their modes. He notes Jacob and Schreyer's 1980 hypothesis that users more focused on the environment are less tolerant of others' behaviors that change these aspects. Watson argues that understanding the root of attitudes towards wilderness and the meanings different groups attribute towards wilderness resources is critical to effectively managing different user groups in wilderness areas. He states that, "An appropriate approach to conflict management may be a proactive one that brings all interests together in order to understand conflicting values and work through compromise or recognition of decision criteria."

Keywords:	Problem definition (theoretical)				
Objectivity:	◑	Applicability	◑	Sustainability:	○
Thoroughness	◑	Useful Information	○		

E.5.27 The nature of conflict between hikers and recreational stock users in the John Muir Wilderness

Watson, A. E., M. J. Niccolucci and D. R. Williams. 1994. Journal of Leisure Research 26:4, 372-385.

Co-authored by Watson of the Aldo Leopold Wilderness Research Institute and Niccolucci with the Intermountain Research Station (both of the USDA Forest Service), and Williams in the Department of Leisure Sciences of the University of Illinois, this article reviews previous academic research/writing on the nature of conflict between user groups. The authors observe that past research has focused on theory, and not proposed methods of effective conflict measurement.

The study measures conflict between mountain bikers and hikers in the John Muir Wilderness in California, based on responses to a mailed survey. Surveys were sent to a group of stock users and hikers randomly sampled from those who secured wilderness permits over the course of six months in 1990. The authors evaluated subjective dislike, undesirability, and goal interference as measures of conflict between these user groups.

Study found that hikers perceived conflict with and expressed undesirability of stock users more frequently than vice versa; however, there was not a significant difference between perceptions of cumulative goal interference. The article concludes that perception of conflict indicates a predisposition towards conflict in general, and does not reflect actual conflict encountered on trails, and may reveal more about group norms than safety incidents.

Keywords:	Problem definition (theoretical)				
Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.5.28 The Contribution of Research to Managing Conflict Among National Forest Users

Watson, A.E., C. Asp, J. Walsh, and A. Kulla. 1997. Trends 34(3): 29-35.

This article in the T*rends* magazine was written by Watson with the Aldo Leopold Wilderness Research Institute of the USDA, Asp, a doctoral candidate at the University of Montana, and Kulla, a manager at the Lolo National Forest. It discusses a consortium of students at the University of Montana, Adventure Cycling (a user group), and the National Forest System managers in the Missoula, Montana area to study conflict at the Rattlesnake National Recreation Area. This article is related to *Sources of Conflict Between Hikers and Mountain Bike Riders in the Rattlesnake NRA* (Watson, Williams, and Daigle, 1991). IMBA cites this article on their website.

The article presents the results of manager interviews as well as a 1989 study that was replicated in 1994, which asked community members about the desirability of management alternatives. Respondents were asked how pervasive the problem is, as measured by letter, phone calls, and other complaint formats. A mail-back questionnaire found 30 percent of hikers that in 1989 and 21 percent of hikers in 1994 who encountered mountain bikers during their visit disliked these encounters, while only 3 percent of mountain bikers who encountered hikers felt similarly each year. The authors conclude that management strategies had successfully reduced conflicts, at least partially.

Staff at the Rattlesnake NRA implemented an awareness campaign to educate mountain bikers how to behave when encountering hikers. A local mountain biking group was also formed, and managers provided information and brochures to the group where appropriate. A laboratory experiment was performed to determine the effectiveness of alternative management strategies, as well as the obtrusiveness, or “magnitude of negative emotional response” to strategies. Conversely than some direct/indirect management schemas, some of the direct techniques such as one-way only traffic and patrolling, were found to be less obtrusive than trail widening, speed control barriers, and speed limits.

The authors conclude that managers should be able to describe the level of conflict, who is involved and how factors have changed. They should address the concerns of hikers who never mountain bike separately from the concerns of hikers who also mountain bike, to avoid creating an “us” versus “them” mentality.

Keywords: Problem definition,(user survey), education, user group meeting, alternate use days, rules and regulations, data collection

Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	◑	Useful Information	◑		

E.5.29 Sources of Conflict Between Hikers and Mountain Bike Riders in the Rattlesnake NRA

Watson, A.E., D.R. Williams and J. J. Daigle. 1991. Journal of Park and Recreation Administration 9: 59-71

This article was written by a research social scientist in wilderness management research at the Intermountain Research Station, USDA (Watson), a professor at the School of Forestry and Wildlife Resources, Virginia Polytechnic Institute and State University (Williams), and an outdoor recreation planner in wilderness management research at the Intermountain Research Station, USDA (Daigle).

The authors studies mountain bikers and hikers in the Rattlesnake National Recreation Area (NRA) outside of Missoula, Montana. They investigated the similarities and difference in how mountain bikers and hikers relate to the recreational resource. A random sampling technique was used to select visitors at the trailhead, who were then mailed a survey that asked about the length, purpose, and mode of their visit, as well as group characteristics. Each visitor was asked to respond with their positive, negative, or neutral feelings about other users; whether the behavior of other users affected their enjoyment; and their attachment to the wilderness.

Only one mountain biker had had a negative experience encountering a hiker, while 32 percent of hikers had disliked meeting mountain bikers. A key finding was that the wilderness bikers felt that they had similar attachment to the wilderness as hikers, while hikers were least likely to agree that the groups were similar. In addition, mountain bikers who did not enter the wilderness area reported less focus on the trail setting than hikers or mountain bikers who entered the wilderness area, although the groups exhibit few real differences.

One of the key implications is that, "Many of those who had not reported disliking meeting the conflicting group on the trails still felt the opposing group was a problem." Similarly, only 20 percent of the hikers could specify the mountain bikers' activity or behavior that was a detractor. The authors conclude that the study favors a "light-handed" technique, to raise mountain bikers' awareness that their behavior is negatively impacting hikers. Similarly, they recommend educating hikers about what to do when they encounter a mountain biker and correcting some misperceptions about how the groups differ.

Keywords:	Problem definition (user survey), education, user information				
Objectivity:	●	Applicability	●	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.6 User Organization Resources

E.6.1 Safety Considerations for Multi-Use Trails

California Equestrian Trails and Land Coalition. 2005.
http://www.calequestriancoalition.com/FinalVerCETLCSafetyGuides.htm

This 2005 publication by the California Equestrian Trails and Land Coalition (CET&LC) recommends design standards and safety guidelines to safely accommodate bicyclists, equestrians, and hikers on the same trail. The CET&LC notes that mountain bicycling use has become a safety issue for equestrians, particularly due to the speed differential with other users; most users travel at 4 to 5 mph while mountain bicyclists frequently travel at faster speeds.

The CET&LC recommends specific trail standards that provide visibility, width, slope, and separation to accommodate a variety of user types. If the trail cannot be built to these standards, they recommend it not be opened to multiple user types. They also recommend education of trail users, including training equestrians to minimize their horses' 'startle factor,' as well as etiquette signage and enforcing trail rules. The report does not state what data the conclusions are based on.

Keywords:	Problem definition (general), design guidelines, width/passing areas, design speed, education, user information, enforcement				
Objectivity:	◑	Applicability	●	Sustainability:	◑

Thoroughness ◑ Useful Information ●

E.6.2 Managing Mountain Biking: IMBA's Guide to Providing Great Riding

International Mountain Bike Association. Webber, P., Ed. 2007. Boulder, CO: International Mountain Bicycling Association.

IMBA's guidebook on managing trails was produced in cooperation with the Recreational Trails Program of the Federal Highway Administration. It was edited by Pete Webber, IMBA's director of special projects and includes contributions from FHWA's Recreational Trails Program Pennsylvania Department of Conservation and Natural Resources, Tennessee Department of Environment and Conservation, Minnesota Department of Natural Resources, Trails and Waterways Division, and the U.S. National Park Service Rivers, Trails, and Conservation Assistance Program. Agencies that noted in the survey that have used this resource to design safe trails and manage user conflict include: State Parks Santa Cruz District, the Hill Country Conservancy (TX), Mecklenburg County (NC), Wake County (NC), Lake Norman State Park (NC) and City of Durango (CO).

The guide begins with the preface that, "When trails are well designed and visitors observe basic trail etiquette, most people, whatever their means of conveyance, will have a satisfying experience on shared trails." Nevertheless, IMBA lists situations where separating users may be advised:

- Crowded trails – to avoid congestion.
- Crowded trailheads – to provide dedicated parking facilities.
- Extraordinary mountain biking trails – trails designed exclusively for mountain biking.
- High-speed trails – trails designated for race-training or use by expert-level users.
- Bike parks – trails for riders to hone mountain biking skills.
- Nature trails – trails that provide seclusion for hikers or that are ADA-accessible.

The section entitled, "Should an existing trail be open to Mountain Bikers?" lists questions designed to assist managers in determining allowable uses. Questions that pertain to conflict issues include the following:

- Will the pre-existing uses mesh with mountain biking?
- Does the trail have a sustainable alignment?
- Could the trail be altered to have a more sustainable alignment?
- Will the trail meet local needs?
- What kind of trails do local cyclists seek?
- Would mountain bikers like to ride the trail?
- Are resources available to meet maintenance needs that may arise with increased use? Is there a local bike club available and willing to support the trail?

The guide also recommends ways of managing safety concerns and user conflicts on shared trails, including trail design, information and education, regulations, and user involvement and partnerships. Information and education include share the trail signs, as well as paid staff patrols, volunteer patrols, peer education, clinics, and handouts. The guide notes that volunteer patrols are a "tangible reminder that mountain bikers are aware of their potential effect on other visitors, are committed to regulating themselves, and are willing to give back to the trails in the form of volunteerism." IMBA discourages the use of speed limits, stating that "speed limits are extremely difficult to enforce, may be un-reasonable for trails with constantly changing terrain, probably won't improve real or perceived safety on the trail, and can damage essential respect and trust."

Designing a trail to reduce safety issues and be sustainable requires thought to the trail flow, or the rhythm of the trail as "determined by the landscape and sequence of terrain." Trail anchors can include large rocks, logs, trees or other obstacles that act as a visual and physical barrier showing where the trail is and requiring users to slow down to pass. Choke points are rocks or a broken tree trunk that acts as a gateway through which trail users must pass. IMBA recommends providing sufficient sight distance for users to see the obstacle and slow down in advance of the feature. Uneven surfacing can also encourage users to slow down and trail hardening is recommended for sustainability in difficult locations. IMBA also recommends bermed turns and consistent flow to minimize soil disruption, although part of the benefit of these elements is that they allow mountain bikers to turn without slowing down.

The chapter about partnerships highlights the importance of soliciting input from user groups. Recommendations include writing specific agreements to define roles and responsibilities; starting simple and building as the relationship develops; and creating a plan for ongoing communication with the group. Some of the guidance is directed at trail managers, while other guidance is intended for use by advocates and trail user groups. For example, the chapter on managing volunteers is directed at a new club or organization. IMBA also recommends forming a Trail Advisory Group to mitigate conflict. Additional partnership solutions include forming user group coalitions, holding volunteer trail work days, and organizing shared-use events.

Keywords: Problem definition (general), design guidelines, speed control measures, trail layout/availability, user information

Objectivity:	◑	Applicability	●	Sustainability:	◑
Thoroughness	◑	Useful Information	●		

E.6.3 Trail Solutions: IMBA's Guide to Building Sweet Single-Track

International Mountain Bike Association. 2004. Boulder, CO: International Mountain Bicycling Association.

IMBA is a worldwide group of individuals, clubs, and organizations focused on advancing and supporting opportunities for mountain biking to grow in recognition and respect as a contributing user of trails. This book is a guide to establishing single-track trails and includes topics on building partnerships, writing proposals, management strategies, and trail design guidelines. The book presents safe trail design and etiquette to manage user conflict: user etiquette and trail design. Several agencies surveyed reported that they use this book as a guidance document for developing single-track trails, including North Carolina Division of Parks and Recreation; Wake County, NC; and Durango, CO.

One of IMBA's "Rules of the Trail" is the precept to 'Always Yield the Trail'. From the rules: "Let your fellow trail users know you're coming. A friendly greeting or bell is considerate and works well. Anticipate other rail users around corners or in blind spots. Show your respect when passing others on the trail by slowing to a walking pace or even stopping. Yielding means slowing down, establishing communication, and being prepared to stop if necessary in order to pass safely." The book explains that user conflicts can be mitigated by following basic trail etiquette.

The book includes discussion of shared-use trails and single-use trails from a perspective of managing user conflict. The authors disagree with the notion that separating users is the best strategy to manage conflict and contents that responsible bike use is compatible with most other types of trail use. The book advocates against single-use trails from the belief that they concentrate users and increase the negative impacts of crowding. The do acknowledge that single-use trails can be useful for reducing safety issues in certain situations, including very crowded trails, high-speed trails, challenge parks, and secluded nature trails.

Another strategy for reducing safety issues is with single direction trails. Single direction trails can alleviate congestion, provide a more predictable experience, and reduce the number of passes between users. Direction restrictions may be combined with user restrictions (such as on a mountain bike only trail,) applied to only one type of user, or applied at certain times or days.

Single-track trails are framed as a tool for speed management of mountain bikers than compared to wider trail widths. Narrow, rough trails encourage focused, slower speed travel, and promote safe sharing of the trail space. The guide generally recommends pinch points to slightly narrow the trail, installed just prior to the area where users should slow down. In addition, anchors in the form of large rocks or objects, can be staggered on the sides of the trail to slow users. The simple suggestions and guidelines presented here are based on extensive experience, although limited in scope to single-track trails.

Keywords:	Problem definition (general), design guidance, , width/passing areas, gradient, speed control features, trail layout/availability, education, user group notification, volunteer programs, events, user group meetings, public notification, ranger patrol, user information, enforcement, rules and regulations				
Objectivity:	◑	Applicability	◑	Sustainability:	◑
Thoroughness	◑	Useful Information	●		

E.6.4 Mountain Bikes on Public Land: A Manager's Guide to the State of the Practice

Keller, K. 1990. Bicycle Federation of America.

This resource provides guidance to trail managers considering how to manage mountain bikers on trails. IMBA cites this article on their website. Chapter 3 discusses Public Safety Considerations and notes that legal liability is frequently waived by state law. Possible actions recommended for managing multiple uses include use designation signs, safety/etiquette signs, identify potential safety hazards with representatives of all trail user groups, work in partnership with local bike shops or clubs to develop and pay for brochures, maps, and signs, emphasize trail preparedness (e.g. the Tread Lightly Program), educate users through interpretive rides, establish a mountain bike trail patrol, issue citations for violations, and encourage local judges to impose work service in the park for trail violation citations. The chapter provides specific recommendations, including size, content, and purchasing details of signs. The section on speed limits notes the challenge for users, as most do not have speedometers, while most managers do not have radar guns to adequately enforce the limit.

Chapter 5 addresses user conflicts, and notes the values and expectations that can lead to or exacerbate conflicts. Perceptions that mountain bikers are not concerned with the environment because they wear brightly-colored clothing or that they are not in control of their bikes when passing lead to negative feelings. A significant concern is whether horses are inherently incompatible with mountain bikes; while some equestrians believe this to be true, others feel it is a matter of proper training. The authors cite two incidents where a horse was spooked by a mountain biker; one in Santa Rosa where the horse broke its leg and had to be shot, and another on Mt, Tam, where a rider was thrown. Major recommendations include signs, user education, ROMP and STOMP events, dispersing uses, encouraging user involvement in advisory councils, maintenance efforts, building projects, volunteer patrols, and as 'Backcountry Hosts.' Design guidelines follow the USFS *Trail Construction and Maintenance Notebook* (Hesselbarth, Vachowski, and Davies, 2007).

With many citations and specific examples, this resource is quite useful, if somewhat dated. Chapter 4 discusses environmental impacts.

Keywords: Problem definition (theoretical, incident data), trail layout/availability , education, user group notification, volunteer programs, events, user group meetings, public notification, rules and regulation, enforcement

Objectivity: ● Applicability ● Sustainability: ●

Thoroughness ◑ Useful Information ◑

E.6.5 A Common Sense Guide for High Country Manners

Backcountry Horsemen of California, No Date

This one-page flyer is a list of behavior guidelines directed to stock users of the backcountry describing means to minimize both environmental damage caused by stock animals as well as conflict between user groups, specifically hikers. It describes proper trail etiquette, as well as suggesting means of communicating with hikers to lessen the likelihood of conflict.

Keywords: Education

Objectivity: ◑ Applicability ◑ Sustainability: ○

Thoroughness ◑ Useful Information ●

E.6.6 Marin Share the Trail Campaign

Bicycle Trails Council of Marin, Access4Bikes. No Date. www.Sharethetrail.org

The Share the Trail campaign was launched by the Bicycle Trails Council of Marin and Access4Bikes to encourage mountain bikers, equestrians and hikers to share the trail. This effort will soon have a new name and mission. The current effort focuses on educating mountain bikers, with an emphasis on changing habits so that mountain bikes will be more accepted on public lands. The Share the Trail website lists the same six rules developed by IMBA (see above), five of which relate to trail user conflicts and are included below. The description of each rule is slightly different than those of IMBA, though the message is the same. The rules encourage mountain bikers to stay off trails closed to bikes, stay off trails after heavy rains, control speeds, yield the trial and take measures to avoid scaring animals.

Keywords: Education

Objectivity:	◑	Applicability	●	Sustainability:	○
Thoroughness	○	Useful Information	◑		

E.7 User Studies

E.7.1 Mountain Bike Survey Update: Results of Spring 1989 Survey

Ford R. 1989. Kepner-Trego Analysis Mountain Bike Situation on Santa Barbara Front Trails Managed by the US Forest Service.

Ray Ford is the manager of Los Padres Forest Association trail volunteer program. He is also the Trail Chair for the Santa Barbara Trails Council. He has been involved in trail management related issues and has written several books on Santa Barbara area trails.[1] IMBA cites this article on their website.

This study of user-groups' trail experiences with mountain bikers was initiated in response to seven written complaints (four by the same individual) to the park service staff in Los Padres National Forest. The study consists of two parts. The first section is a two-part survey to evaluate hikers', equestrians', and Sierra Club members' experiences with mountain bikers they encounter on the trail, and also to see what percentage of trail use each group amounted to. This survey was first conducted in 1987 and then again two years later (1989) to assess if conditions had changed. In both surveys, around 70 percent of respondents responded that mountain biking had never posed a safety concern and had never distracted them from their enjoyment. In the two years between the two surveys, mountain biking increased from 7 to 24 percent of total trail use.

In the second part of the report, the forest service gathered together representatives from each major trail user group in order to come up with an agreed upon strategy for mountain bike use on the trails. Several different options were discussed and five were picked from the list as the most substantial/discussed possibilities. These were:"Current Management with an Emphasis on Safety and Education, Selected Trails Where Bicycle Use is Permitted, Close All Front Country Trails to Bicycles, Regulate Day/Time of Bicycle Use on Trails, and Regulate Direction of Bicycle Travel on Trails." Using a threat analysis matrix to determine the probability and severity of several environmental, experiential, monetary, and safety costs, the group determined that the park should continue the Current Management with an Emphasis on Safety and Education scenario so long as mountain biking use continues at its current intensity.

This is a well-backed report on the management of mountain biking in the Santa Barbara area. It shows that the majority of users were not negatively affected by mountain bike use in Los Alamos National Forest, even as mountain bike use on trails was intensifying. Most users that were surveyed felt that safety was only a concern with a limited number of rouge, extreme mountain bikers. It seems that the initial concern that sparked this report was primarily voiced by a few passionate individuals. Consequently, when a large, representative group was gathered to deal with the issue of mountain biking, they concluded that the best possible course of action was to let it continue while maintaining bike management, enforcement, and education in the park.

[1] Source: http://www.independent.com/staff/ray-ford/

The results of the report seem well founded and representative; over 500 users were included in the surveys. However, the report is 15 years old—trail user group attitudes, trail user group characteristics, and mountain bike trends may have changed significantly since that time.

Keywords:	Problem definition (user survey)				
Objectivity:	●	Applicability	◑	Sustainability:	○
Thoroughness	●	Useful Information	◑		

E.7.2 Access to our Public Lands: Mountain Bikes, the Concept of Public Ownership, and the Fatal Flaw in *Bicycle Trails Council of Marin v. Babbit*

Lucke, J. No Date. No publishing information.

This article is a review of court decisions related to allowing or prohibiting mountain bikers on trails. For each decision, Lucke argues why management decisions were based on preconceived notions and biases that lead to restrictions of mountain bikers. The article was unpublished, and no information provided about the author.IMBA cites this article on their website.

Lucke posits that “conflicts inevitably arise on these [public lands] because there are simply too many people.” He discusses the roots of perceptions about access to public lands, arguing that restricting mountain bikers from trails is misplacing the problem and relying on incomplete, biased, or incorrect assumptions. He also states that the NPS and BLM’s approach to managing mountain bikers has led to negative perceptions from other users, leading to an unpleasant experience for all users.

This analysis is not based on counts or incident reports but on an individuals’ review of court decisions.While most of the paper is strictly opinion, the author makes some valid arguments for the acceptance of mountain bikes on trails previously only used by hikers and equestrians. The first argument is that mountain bikers were excluded from trails based on insufficient evidence that they were causing unacceptable damage to trails.

Keywords:	Problem definition (general)				
Objectivity:	○	Applicability	◑	Sustainability:	◑
Thoroughness	○	Useful Information	◑		

Appendix F. Agency Surveys Returned

F.1 Federal Agencies

F.1.1 Bureau of Reclamation

Agency contact information

Name of agency:	Bureau of Reclamation
Street address:	jkirby@lc.usbr.gov
Name/position of contact:	Jason Kirby / Realty Specialist
Phone/e-mail:	(702) 293-3171
Responsibility for trail use policy/management:	The Bureau of Reclamation in our Lower Colorado Region does not directly manage trails. We have recreational leases in places on our lands with third party land managers. These entities typically include municipalities and other Federal lands management agencies.

Agency and Trail System Information

Type(s):	Multi-use trails including hiking, biking, & equestrian trails
Size (acres managed):	120,000 acres
Trail system miles managed:	120
Trail surface types:	Multi-use including asphalt, compacted gravel, native material, soil cement
Trail user types accommodated:	Equestrian, walkers, bicyclists

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Most complaints usually revolve around different user groups. Predominantly complaints on Reclamation land are related to Off Road Vehicle (ORV) use and other users.

Occasionally there are conflicts with walkers and bicyclists. Additional conflicts are competing special events with everyday local users.

From which group(s) do these complaints usually come?

Local residents. Walkers and hikers. Occasionally we hear complaints from bicyclists.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

During our busy seasons which are spring & fall on weekends

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

At turns and corners but most involving ORV use are in high traffic areas where roads cross the multi-use trail system.

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)
Walkers and ORV users on the land. Sometimes bicyclists and ORV users.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?
Meet up groups and biking and running clubs have conflicts with local residents. The groups can be large, should be permitted for special events and overtake a section of trail.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint	x			
Reported Incident		x		
Injury due to collisions			x	
Non-injury collision			x	
Damage to natural resources	x			
Close calls negatively affect user experience		x		
Congestion or overcrowding on trails		x		
Other (Please Specify)	x			ORV use in the trail corridor with other users

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.
Design issues for the competing uses of walking and/or biking. For example bikes flying around corners.

The perception that ORV users are always at fault is an issue as well.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?
The managing partners respond, Trail watch volunteers follow up. We have held stakeholder meetings and trail surveys inviting all users.

How successful were the physical response(s)?
Positive. When we have been able to break the issues down and bring everyone together it is a good experience.

What has been your agency's management response?
(i.e., speed limits, citations, exclusion of particular user groups, etc.)
Encouraging our managing partner to issue citations, physical barriers, signage and education

What trail policy statements, regulations, guidelines, etc. do you have to document the response?
Management policies in place with each partner. This policy outlines acceptable maintenance and uses.

An active partnership of stakeholders that have agreed upon policy and enforcement of local City code on specific violations.

How well did you find the management response(s) work?

A response to forums, meetings, and a combination of enforcement has been positive.

What other responses did your agency try that did not work?

N/A

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

A handful of chance onsite meetings with ORV users and educating them on the proper uses and areas.

F.1.2 Lake Tahoe Basin Management Unit

Agency contact information

Name of agency:	Lake Tahoe Basin Management Unit
Street address:	35 College Drive / South Lake Tahoe, CA96150
Name/position of contact:	Garrett Villanueva, Assistant Forest Engineer
Phone/e-mail:	530.543.2762 / gvillanueva@fs.fed.us
Responsibility for trail use policy/management:	Oversee all NFS roads and trails at Lake Tahoe.

Agency and Trail System Information

Type(s):	US Forest Service
Size (acres managed):	160,000 acres
Trail system miles managed:	415 miles
Trail surface types:	Paved and unpaved
Trail user types accommodated:	OHV, Motorcycle, Hiking, equestrian, dog walking (on leash), bicycling (road and MTB)
Additional resources:	§ 261.55 Motor Vehicle Use, FSH 2309.18 Trail Management Handbook.

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts? (From which groups, related to which other users, etc.)

As a provider of many public trails we don't recognize user conflicts, we recognize use conflicts. A user conflict is between two individuals, the Forest Service manages for use conflicts that reflect a trend of conflict between use groups as a result of uses that are not compatible as a result of trail design, use types, or lack of management.

It is difficult to identify the nature of most complaints because complaints are localized and specific to certain areas: Lam Watah Trail is dog poop, Camp Richardson is equestrian use of trails. Mountain bike conflicts were predominate on the Lake Valley Trail (Xmas Valley), however, the trail has been rerouted and reconstructed and use conflicts between bikers and hikers are no longer a common issue.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Use conflicts occur for a variety of reasons. Federal Highways completed a study on the reasons use conflicts occur. Clearly trail design/layout may contribute or resolve use conflicts, however, signage, setting, differing user goals, differing user technology, speed differential between users and other site specific factors affect use conflict.

Does you agency collect or record incidents or complaints? (If yes, would you be willing to provide us with that information?

We record incidences, however, we have no recorded incidents where an injury was involved. There is nothing to provide.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint			x		
Reported Incident					x
Injury due to collisions					x
Non-injury collision					Don't know
Damage to natural resources			As a result of use conflict?		
Close calls negatively affect user experience		As a result of the 5%er's (WAG)			
Congestion or overcrowding on trails	July-August on around 10 different trails				
Other (Please Specify)					

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

The primary cause for perceived use conflicts is attitude. Those with a trail sharing attitude can get along with anyone.

Speed Differential between use groups. Speed differentials of more than about 12 mph causes an increase in use conflicts.

Lack of management – signage to set user expectations such as allowed uses is very important. Without this users will take management upon themselves and may contribute to use conflicts by looking for a conflict. Management may also help users understand trail sharing etiquette so that they may have a positive trail experience.

Trail design. Short sight lines, confined areas, over steep grades, may all contribute to use conflicts.

The bottom line is that use conflicts as a trail issue is very subjective and determined by individuals. The repeat complainers or offenders are looking for a conflict.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

We have used all the above examples, however, we embrace shared use management. Over use of exclusion is harmful for all trail users and we avoid it unless there are safety issues.

We have used TTFs to slow down mountain bikers and meet their needs on certain trails. This approach is not appropriate on all trails.

How successful were the response(s)?

Very.

What design guidelines documents does your agency use?(please provide a link if available online)

FSH2309.18 and everything else we can find.

What trail policies or management techniques does your agency use? (please provide a link if available online)

Shared Use – Shared Use Sustainable Yield Act

What other responses did your agency try that did not work?

It is important to identify what is a perceived conflict vs. an actual conflict.Reaction to perceived conflicts causes confusion and may result in exclusion for certain use groups.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

They are smattered amongst the responses above.

F.2 California State Park Agencies

F.2.1 Calaveras Big Trees

Agency contact information

Name of agency:	California Dept of Parks and Recreation, Calaveras Big Trees
Street address:	1170 E. Highway 4
Name/position of contact:	Gary Olson, Park Superintendent
Phone/e-mail:	209-795-8904 golson@parks.ca.gov
Responsibility for trail use policy/management:	yes
	yes

Agency and Trail System Information

Size (acres managed):	6500
Trail system miles managed:	15
Trail user types accommodated:	Foot on trails, bicycles allowed on fire roads
Additional resources:	

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

Bicycles being used on foot trails

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

No particular place

Does you agency collect or record incidents or complaints?

Depends on the severity of the incident

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint		X		
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources			X	
Close calls negatively affect user experience		X		

	Weekly	Monthly	Annually	Less than once a year
Congestion or overcrowding on trails				X
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Illegal use of bicycles on foot trails

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

Signage, increased enforcement and patrols

How successful were the response(s)?

Somewhat

What design guidelines documents does your agency use?(please provide a link if available online)

State Parks Trails Handbook

What trail policies or management techniques does your agency use? (please provide a link if available online)

State Parks Operations Manual

What other responses did your agency try that did not work?

N/A

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

Education, increased patrols, and providing alternatives

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

N/A

F.2.2 Columbia State Park

Agency contact information

Name of agency:	California Dept of Parks and Recreation, Columbia State Park
Street address:	11255 Jackson St, Columbia, CA 95310
Name/position of contact:	Vince Sereno, Sector Superintendent
Phone/e-mail:	209-536-2916 vsere@parks.ca.gov
Responsibility for trail use policy/management:	yes
	yes

Agency and Trail System Information

Size (acres managed):	252 acres
Trail system miles managed:	One half mile
Trail user types accommodated:	foot
Additional resources:	

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

Motorcycles being operated on the trails

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

No particular place

Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

Depends on the severity of the incident

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint		X		
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources			X	
Close calls negatively affect user experience		X		

	Weekly	Monthly	Annually	Less than once a year
Congestion or overcrowding on trails				X
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Motorcycles are not permitted, so illegal use is the problem

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

Signage, increased enforcement and patrols

How successful were the response(s)?

Somewhate

What design guidelines documents does your agency use?(please provide a link if available online)

State Parks Trails Handbook

What trail policies or management techniques does your agency use? (please provide a link if available online)

State Parks Operations Manual

What other responses did your agency try that did not work?

N/A

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

Short trail, low use, isolated area of park

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

N/A

F.2.3 Colorado Desert District

Agency contact information

Name of agency:	Calif. State Parks, Colorado Desert District
Street address:	200 Palm Canyon Drive, Borrego Springs, Ca. 92004
Name/position of contact:	Jim Dascoulias District Trails Coordinator
Phone/e-mail:	760-765-0604 jdascoulias@parks.ca.gov

Agency and Trail System Information

Size (acres managed):	700,000 +
Trail system miles managed:	200
Trail user types accommodated:	Hikers, bikers, equestrian, accessible
Additional resources:	

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

None

Does you agency collect or record incidents or complaints?

Yes

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint				
Reported Incident				x
Injury due to collisions				x
Non-injury collision				x
Damage to natural resources		x		
Close calls negatively affect user experience				x
Congestion or overcrowding on trails			x	
Other (Please Specify)				

No further information provided.

Four Rivers Sector

Agency contact information

Name of agency:	California Department of Parks and Recreation, Four Rivers Sector
Street address:	31426 Gonzaga Road, Gustine, CA 95322
Name/position of contact:	Greg Martin, Sector Superintendent
Phone/e-mail:	209-826-1197, gmart@parks.ca.gov
Responsibility for trail use policy/management:	Policy: Greg Martin, Sector Superintendent
	Management: Mike Stanley, Sector Maintenance Chief

Agency and Trail System Information

Size (acres managed):	Total Acres within the Four Rivers Sector: approximately 37,000
Trail system miles managed:	Total Miles of Trails within the Four Rivers Sector: approximately 45
Trail user types accommodated:	Multi –use trails: pedestrian, equestrian, bicycles
Additional resources:	NA

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails? (From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

No formal reports of trail conflicts have been reported within the Four Rivers Sector to the best of my knowledge. Occasionally, Pacheco State Park has heard from equestrian riders that their horses were spooked by people on multi-use trails during large special events. These are just anecdotal and occur infrequently.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

No reports of conflicts have been reported to the best of my knowledge.

Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

No, we do not have records of trail conflicts.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint				x
Reported Incident				x
Injury due to collisions				x
Non-injury collision				x
Damage to natural resources				x

	Weekly	Monthly	Annually	Less than once a year
Close calls negatively affect user experience				x
Congestion or overcrowding on trails				x
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

No, we do not have records of trail conflicts.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

No, we do not have records of trail conflicts.

How successful were the response(s)?

No, we do not have records of trail conflicts.

What design guidelines documents does your agency use?(please provide a link if available online)

No, we do not have records of trail conflicts.

What trail policies or management techniques does your agency use? (please provide a link if available online)

No, we do not have records of trail conflicts.

What other responses did your agency try that did not work?

No, we do not have records of trail conflicts.

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

No, we do not have records of trail conflicts.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

No, we do not have records of trail conflicts.

F.2.4 Gavilan Sector

1. **Agency contact information**

Name of agency: GAVILAN SECTOR
Street address: 19 FRANKLIN ST / PO BOX 787 SJB, CA 95[illegible]
Name/position of contact: EDDIE GUARACHA
Phone/e-mail: 831-623-4526
Responsibility for trail use policy/management:

2. **Agency and Trail System Information**

Size (acres managed): 87,000 ACRES
Trail system miles managed: 363 MILES (FIREROADS + TRAILS)
Trail user types accommodated: HIKERS, BIKERS, EQUESTRIANS
Additional resources:

3. **Documenting the Problem**

a. **What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ? (From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)**

Very rarely, complaints from equestrians about mountain bikers. Typically, if equestrians and mountain bikers are on the same trail, it is a fire road with plenty of room for all user groups

b. **Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)**

Single track trails

1

c. Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

No.

d. How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint			2-3	
Reported Incident				X
Injury due to collisions			0	
Non-injury collision			0	
Damage to natural resources			2-3	
Close calls negatively affect user experience			0	
Congestion or overcrowding on trails			0	
Other (Please Specify)				

e. What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Mtbr's riding too fast on single track when they encounter equestrians

| 3

4. **Responses to Trail User Conflicts**

   a. **What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)**

posting trail etiquette. 99.9% of users are well informed

   b. **How successful were the response(s)?**

N/A

   c. **What design guidelines documents does your agency use? (please provide a link if available online)**

Dept. Trails Manual

   d. **What trail policies or management techniques does your agency use? (please provide a link if available online)**

See above.

e. **What other responses did your agency try that did not work?**

None

f. **If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?**

The amount of trails we have: 200+ miles single track, 200+ miles of fire roads

g. **Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?**

No

5. **Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?**

Agency name: N/A

Agency contact (if available):

Phone/e-mail:

a. **In particular, what solution or strategy has the above agency used?**

Thank you for your time!

F.2.5 Gold Fields District

Agency contact information

Name of agency:	California State parks, Gold Fields District
Street address:	7806 Folsom Auburn Road, Folsom, CA 95630
Name/position of contact:	Jim Micheaels, Senior Park & Recreation Specialist
	Rich Preston, Public Safety Superintendent
Phone/e-mail:	(916) 988-0513, jmiche@parks.ca.gov
Responsibility for trail use policy/management:	JM - District Trail coordinator, Trail planning (both projects and management plans). RP – public safety and law enforcement.

Agency and Trail System Information

Size (acres managed):	Folsom Lake SRA – 20,000 acres (land and water), Auburn SRA - 26,000 acres.
Trail system miles managed:	Folsom Lake SRA – approx. 100 miles, Auburn SRA - 118 miles of trail.
Trail user types accommodated:	Hikers/runners/pedestrians, equestrians, mountain bikes, road bikes (paved trails), accessible trails.

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

Most of the user group conflicts on dirt trails are between equestrians and mountain bikes and mountain bikes or pedestrians and mountain bikes. Folsom Lake SRA does have paved trails and we occasionally have conflicts between pedestrians and road bicyclists on the paved trails.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

Areas where user conflicts most frequently occur are illegal use of trails designated equestrian/pedestrians by mountain bikes.

These conflicts most often occur in areas where trails are intensively used by both equestrians and mountain bikes and where limited use trails either are in close proximity or intersect with multi-use trails. The specific location in Folsom Lake SRA where user conflicts most often occur is the Granite Bay area which has intensive trail use in this area and several places where equestrian/ pedestrian and multi-use trails intersect. Other locations where user conflicts occur are on steep sections of trail or blind corners. Auburn SRA has fewer trail user conflicts than Folsom Lake SRA.

Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

If an incident results in injury or criminal activity an Incident Report is completed by a State Park peace officer. Violation notices can be issued for illegal trail use of violators are caught in the act by a peace officer. Complaints are not systematically recorded or retained by State Parks. Sometimes complaints are in the form of an e-mail or phone call to various State Park staff and may be shared with other Parks staff to address a particular problem, but this information is not retained in any comprehensive or systematic manner.

Equestrian user groups who primarily use Folsom Lake SRA have developed a "Park Watch" internet site where complaints and incidents can be recorded by trail users. Occasionally these reports are passed onto State Parks staff. This is not a State Park system, but a user group developed and operated system.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint – **informal complaint***	X			
Reported Incident **- these are incidents to which we respond.**		X		
Injury due to collisions		More like quarterly – not as frequent as monthly, but more than annually.		
Non-injury collision **– this type of incident is likely not reported, so frequency is uncertain.**		X?		
Damage to natural resources **– damage to resources isn't usually a result of user conflicts. More often is it s result of the intensity of use or illegal activity such as building bike jumps or other illegal trails.**				
Close calls negatively affect user experience – **mostly unreported, but may occur weekly. Again most of this is the result of illegal use of limited use trails.**	X			
Congestion or overcrowding on trails – **this doesn't seem like a consequence of user conflict – but one of the causes.**	X			
Other (Please Specify)				

*State Parks comments on each category of complaint are in bold.

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Back in 2000, when user conflicts between equestrians and mountain bikes started to increase at Folsom Lake SRA, the District set up a "Folsom Lake Trails Advisory Group" (FTAG) to address some of these user conflict issues. The group had representatives from equestrian, mountain bike, runner, hiker and youth user groups. The group was facilitated by State Parks staff. The group met roughly monthly over a couple of years. The group's goal was to find ways to reduce user conflicts. One of the causes of user conflicts the group identified was the lack of trails (relative to demand) for many users, but in particular mountain bikes. The group undertook a project to determine if an existing limited use trail could be successfully changed into a multi-use trail. Trail condition surveys were done, necessary modifications and re-routes of the trail were identified and specific ideas for management of the trail were identified. Public meetings were held to discuss the proposal. A tenuous and somewhat grudging consensus by the FTAG was developed to present the proposal to change the limited use trail to multi-use to the District Superintendent. At the time, the Department had just initiated a process to revise the General Plan for the park unit. The District Superintendent believed the GP would address the trail system in its entirety and that it was more appropriate to defer to the GP on any changes in trail use designations. This decision, the length of time it took to complete the GP, and the fact that GP's are not really designed to make specific trail use designation decisions took much of the energy out of the FTAG – which dissolved shortly thereafter with members leaving the process dissatisfied. The GP was completed, but it did not make specific trail use designation decisions. Those decisions will be made in a unit Road and Trail Plan which has been initiated this year.

The District did designate uses of trails back in the 1990's at a time when mountain biking was gaining popularity, but prior to the most intense user conflicts. Many trail segments were designated equestrian/pedestrian use only. The District has posted use designations on many trails, but the posting is not perfect. The District has undertaken to revise its "posted order" – a form of park specific regulation – regarding trail use designations. This posted order will not make use designation changes, but just better document the current use designations. Any changes in use designations would occur in the unit Road and Trail Management Plan.

The District has posted speed limit signs, caution signs and trail use etiquette sings on some trails.

The District has initiated spot enforcement of trail use designations to address illegal trail use.

The District has looked at a couple of re-alignments of trails to separate trails with different use designations, but has not implemented these yet.

Most user conflicts result from the illegal use of equestrian pedestrian only trails by mountain bikes. The underlying causes of these conflicts include: the sheer volume and intensity of use in certain areas, particularly by mountain bikes; the limited number of trails (relative to amount of use) available to mountain bikes; the close proximity and intersection of limited use trails and multi-use trails in some areas; the poor alignment, design or condition of existing trails; the speed of mountain bikes on trails; instances of poor etiquette by all trail users. The long history of user conflicts at Folsom Lake SRA has led to entrenched negative perceptions by both equestrians and mountain bikes of the other user group. Neither of these groups is homogenous in their use of trail etiquette, but the negative actions and rhetoric of some users have affected the wider perceptions of many users on either side of this conflict.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

How successful were the response(s)?

Signing has not generally been successful in preventing illegal use of trails or compliance with speed limits. Spot enforcement has been seen positively by equestrian groups, but the actual success is uncertain. Too early to tell. Overall, the District's efforts to reduce user conflicts at Folsom Lake SRA have not been particularly successful.

What design guidelines documents does your agency use?(please provide a link if available online)

The Department has a Trails Handbook which provides guidelines for the development, construction and maintenance of trails. Karl Knapp can provide a copy of the Handbook.

The Trails Handbook was developed initially in 1991. Most of the trails at Folsom Lake SRA predate the Handbook guidelines and many trails are poorly aligned and not adequately maintained. Re-aligning and re-constructing these trails is very expensive. The District has done several re-routes of trail segments as opportunities for funding (grants) have been available.

What trail policies or management techniques does your agency use? (please provide a link if available online)

See 4a above. The District has designated the allowed uses on trails. Some are limited use, some a multi-use.

The District does have volunteer patrol groups including the Mounted Assistance Patrol at Folsom Lake SRA and a volunteer patrol groups at Auburn SRA (both equestrian and mountain bike?)?

The District has specific staff assigned to work with various user groups, including the volunteer patrols, equestrian user groups and mountain bike user groups. State Parks staff attends the meetings of these groups and work with various user groups on trail work days. One of these work days recently included both mountain bikes and equestrians.

What other responses did your agency try that did not work?

The District is uncertain of the degree of success of any of our responses in effectively reduction trail user conflicts. Some responses may have a short term positive effect, but it does not seem like this reduction in conflict is sustained.

For Folsom Lake SRA, the District believe part of the long term solutions include developing more trail opportunities for all users – but particularly mountain bikes - either through development of new trails or changes in use; and addressing the design and conditions inadequacies of the current trail system through repairs, re-routes and improved maintenance. Given the current intensity of use and the seemingly endless latent demand for trail use – it could be that some limitations on use, such as further reduction in special events involving trails may be needed to help reduce use conflicts. Perhaps our trails are exceeding their carrying capacity – both physically and socially.

F.2.6 Refugio SB

Agency Contact Information

Name of agency:	State Parks
Street address:	10 Refugio Beach Rd Goleta, CA 93117
Name/position of contact:	Scott Anderson/Ranger
Phone/e-mail:	805-968-3852/sanderson@parks.ca.gov

Agency and Trail System Information

Size (acres managed):	Roughly 9K acres
Trail system miles managed:	Roughly 20mi
Trail user types accommodated:	Bikers, hikers, walkers

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?

We don't receive any complaints

- **Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)**

N/A

Does you agency collect or record incidents or complaints?

If we had any complaints or incidents, we would generate a report number if necessary and write a report on the incident.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint				X
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources				X
Close calls negatively affect user experience				X
Congestion or overcrowding on trails				X
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

N/A

Responses to Trail User Conflicts

What has been your agency's response?

N/A

How successful were the response(s)?

N/A

What design guidelines documents does your agency use?(please provide a link if available online)

N/A

What trail policies or management techniques does your agency use?

We have our trails signed and patrol them regularly

What other responses did your agency try that did not work?

N/A

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

I feel that we have a knowledgeable and respectful group of hikers, walkers and bikers who frequent our trails.

F.2.7 San Joaquin Sector

Agency contact information

Name of agency:	Department of Parks and Recreation
Street address:	5290 Millerton Rd. Friant, CA 93626
Name/position of contact:	Kent Gresham, Acting San Joaquin Sector Superintendent
Phone/e-mail:	559-822-2332, kgresham@parks.ca.gov
Responsibility for trail use policy/management:	Kent Gresham

Agency and Trail System Information

Size (acres managed):	12,520 acres
Trail system miles managed:	16 miles
Trail user types accommodated:	Multi-use and pedestrian/equestrian only
Additional resources:	

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

No significant complaints.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

N/A

Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

No.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint				X
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources				X

	Weekly	Monthly	Annually	Less than once a year
Close calls negatively affect user experience				X
Congestion or overcrowding on trails				X
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)
Signs to regulate types of trail users.

How successful were the response(s)?
Successful.

What design guidelines documents does your agency use?(please provide a link if available online)
Department policy.

What trail policies or management techniques does your agency use? (please provide a link if available online)
Trail management plan.

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?
Trail groups work together.

F.2.8 Santa Cruz District

Agency Contact Information

Name of agency:	California Dept of Parks & Recreation
Street address:	Santa Cruz District 303 Big Trees Park Road. Felton, Ca. 95018
Name/position of contact:	Chris Pereira – Trails Supervisor
Phone/e-mail:	(831) 335-6321 / cpereira@parks.ca.gov

Agency and Trail System Information

Size (acres managed):	
Trail system miles managed:	262
Trail user types accommodated:	Hike, Bike, Equestrian
Additional resources:	

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails? (From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs' on- or off-leash.)

Most complaints come from hikers & equestrians about bikes riding too fast on open and closed to bikes. I have personally been forced off the trail by speeding mountain bikers while performing trail maintenance, 3 times in the last 10 years. Twice in Fall Creek State Park and once in the Forest of Nisene Marks State Park.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

Sometimes at blind corners, but also at long straight away, where bikes can pick up a lot of speed.

Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

Yes, when they receive a formal complaint, but most often just inform staff that an incident has occurred. It is rarely documented. Our Public Safety Officer queried back two years and found no formal written complaints or incidents.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint			X	
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources			X	
Close calls negatively affect user experience		X		
Congestion or overcrowding on trails		X		
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Probably design issues, mountain bikes riding on closed trails, lack of trails for just mountain bikers to ride on.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

- excluding certain user groups
- constructing pinch points to reduce bike speeds
- posting signage

How successful were the response(s)?

Excluding bikes from certain areas has not deterred the user group from using the trail. Pinch points have worked at reducing speeds, but sometimes they have been removed by the user group. Sign gets vandalized or removed at trails that are closed to bikes or horses.

What design guidelines documents does your agency use?(please provide a link if available online)

-State Park Trail Guidelines and have used IMBA trail book "managing mountain biking" for some bike specific trail projects.

What trail policies or management techniques does your agency use? (please provide a link if available online)

- posting trail signage
- certain policies excluding certain user groups have been around a long time and are still in affect

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What other responses did your agency try that did not work?

Continually posting sings then having them removed.

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

We don't get many formal complaints but I do here about trail user concerns over bike speed, when I'm on the trail working. I also here from hikers about horse manure and the damage to trails caused by horses and bikes.

I don't believe you can remove conflicts on trails, certainly not in parks that have high volume of users like our State Parks here in the Santa Cruz District.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Not sure if it is a success story, but Mountain Bikers of Santa Cruz put on a carrot ride at Wilder Ranch State Park. Bikers hand out carrots to horses to help make a positive connection with the horse, in hopes that the horse and rider do not get spooked when bikes approach. I have not heard either way how successful it was.

F.2.9 Topanga Sector

1. **Agency contact information** (to be completed by Alta)

Name of agency: California State Parks

Street address: 1501 Will Rogers S. P. road Pacific Palisades CA 90272

Name/position of contact: Lynette Brody - Topanga Sector Superint.

Phone/e-mail: LBrody @ Parks . CA . Gov

Responsibility for trail use policy/management:

2. **Agency and Trail System Information** (to be completed by Alta)

Type(s):

Size (acres managed):

Trail system miles managed:

Trail surface types:

Trail user types accommodated:

Additional resources:

3. **Documenting the Problem**

   a. **What is the nature of most of the complaints you receive related to user conflicts? (From which groups, related to which other users, etc.)**

Perception of Mountain Bikes being unsafe; Speeding, Element of Surprise, Horses mess up trails after rain.

   b. **Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)**

Older trails now open to all user groups. Trails w/o step off access, Sight distance, Blind curves.

1

c. Does you agency collect or record incidents or complaints? (If yes, would you be willing to provide us with that information?

Yes. We can give you statistics, but not Confidential reports.

d. How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint			X		
Reported Incident				X	
Injury due to collisions				X	
Non-injury collision				unknown	
Damage to natural resources		X			
Close calls negatively affect user experience		X	Not	Reported	
Congestion or overcrowding on trails					
Other (Please Specify)					

e. What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

trail design, inappropriate use, -
Mountain bike - Speed
Horses - Speed
Hikers - Hiking 3-4 Abreast, Not allow for
Other users to pass
& All users wearing iPods - Don't hear

Do you have data supporting this information? If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111

4. Responses to Trail User Conflicts

a. What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

2008 trail Policy
Trail use Change policy

b. How successful were the response(s)?

Education, public meetings
letting all users group know
about our process.

c. What design guidelines documents does your agency use? (please provide a link if available online)

Our State guidelines

d. What trail policies or management techniques does your agency use? (please provide a link if available online)

trail Policy
Dept Notice 2008
Ca. Code of Resources - Enforcement Codes

e. What other responses did your agency try that did not work?

Not being responsive!

f. Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Our Dept should educate All field employees of the "Change in Use" process. Stick to policy.

5. Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name: Conejo Open Space, Thousand Oaks CA

Agency contact (if available): National Parks - SMMT's

Phone/e-mail: MRCA - Walt Young

* info on Internet

a. In particular, what solution or strategy has the above agency used?

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Thank you for your time!

F.2.10 Turlock Lake SRA/Caswell Memorial SP/Bethany Reservoir

Agency contact information

Name of agency:	CA State Parks
Street address:	22600 Lake Road, La Grange, CA 95329
Name/position of contact:	Bill Lutton / Park Superintendent
Phone/e-mail:	wlutt@parks.ca.gov

Agency and Trail System Information

Size (acres managed):	228 Acres Turlock Lake SRA / 258 Acres Caswell Memorial SP/ 47 Acres Bethany Reservoir
Trail system miles managed:	3 Miles
Trail user types accommodated:	Hikers, Disabled

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

I have experienced no complaints other than dogs off leash.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

N/A

Does you agency collect or record incidents or complaints? (If you are willing to share your data with us, please send to hannahkapell@altaplanning.com or contact us at (510) 540-5008 x111)

In the event of complaints, we resolve the issue through interpretation, education or enforcement. Recording of the complaint would only occur in the enforcement arena.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint				X
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources			X	
Close calls negatively affect user experience				X
Congestion or overcrowding on trails				X
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

The trails are well defined and utilized for foot traffic and ADA accessibility. Inclement weather has not been a factor for usage.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

We utilize signage / posting, interpretation and enforcement techniques.

How successful were the response(s)?

I would gauge our successes high as we have little to no reported conflicts of trail usage.

What design guidelines documents does your agency use?(please provide a link if available online)

ADA guidelines if the trail is accessible. Departmental guidelines for width, designed usage, number of projected users, community input etc

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What trail policies or management techniques does your agency use? (please provide a link if available online)

Departmental policies.

What other responses did your agency try that did not work?

N/A

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

Clear signage, proactive interpretation and education and enforcement.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

I would submit public education is the most effective tool. If the users understand the spirit of the trail development. If they understand the goal of the agency and its mission.

F.3 State Parks Agencies

F.3.1 North Carolina Division of Parks and Recreation - Lake Norman State Park

Agency contact information

Name of agency:	North Carolina Division of Parks and Recreation – Lake Norman State Park
Street address:	159 Inland Sea Lane, Troutman, NC 28166
Name/position of contact:	Casey Rhinehart / Park Superintendant
Phone/e-mail:	707 528 6350 / Casey.rhinehart@ncdenr.gov

Agency and Trail System Information

Type (s):	Hiking and Mountain Biking/Hiking
Size (acres managed):	Hiking = 7 miles and Mtn Biking/Hiking = 18
Trail system miles managed:	About 25
Trail surface types:	Earth
Trail user types accommodated:	Hiking and Mtn Biking

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Mtn bikers and hikers complaining about each other

Where do trail user conflicts most frequently occur?

Everywhere

Does your agency collect or record incidents or complaints?

Only if the visitor requests to document it

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint				x	
Reported Incident					x
Injury due to collisions					x
Non-injury collision					x
Damage to natural resources					
Close calls negatively affect user experience				x	
Congestion or overcrowding on trails				x	
Other (Please Specify)					

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.
Perceptions of user groups

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)
Post trail etiquette at trailhead and speak with users about sharing trail

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How successful were the response(s)?
Unknown

What design guidelines documents does your agency use?(please provide a link if available online)
For all trails, we have trail design guidelines. Use a lot of IMBA guidelines on MTB trails

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What trail policies or management techniques does your agency use? (please provide a link if available online)
Agency trail guidelines

What other responses did your agency try that did not work?
None

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?
No

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name:	NCDPR
Agency contact (if available):	Tim Johnson
Phone/e-mail:	tim.johnson@ncdenr.gov

In particular, what solution or strategy has the above agency used?
Not sure

F.3.2 Oregon Parks and Recreation

Agency Contact Information

Name of agency:	Oregon Parks and Recreation Department
Street address:	725 Summer St NE, Suite C, Salem, OR 97301
Name/position of contact:	Rocky Houston, State Trails Coordinator
Phone/e-mail:	(503) 986-0750 / rocky.houston@state.or.us

Agency and Trail System Information

Documenting the Problem

Type(s):	State agency
Size (acres managed):	OPRD properties include almost 102,500 acres of natural, recreational and historic resources in every part of Oregon
Trail system miles managed:	Approx. 960 miles of recreational trails and 220 non-vehicle bridges
Trail surface types:	Natural, compacted gravel, pavement, boardwalks, etc.
Trail user types accommodated:	Hiker, Cyclist, Mountain Biking, Equestrian,

What is the nature of most of the complaints you receive related to user conflicts?

Not sharing the trail, ie not following the trail etiquette protocols to allow passing, etc.; speed of cyclists; horse manure on trail; specific users impacting the trail, which makes it unusable part of the year (erosion, widened wet areas, etc.)

From which group(s) do these complaints usually come?

All user groups have complaints. Mountain bikers seem to have less complaints about other users, but we have the fewest user miles available to them.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

More during summer months and weekend, ie peak use times.

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)

Road cyclists and equestrians, mountain bikers and hikers

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Hiker – Hiker; Runner – Walker;

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint	X			
Reported Incident		X		
Injury due to collisions			X	
Non-injury collision			X	
Damage to natural resources	X			
Close calls negatively affect user experience		X		
Congestion or overcrowding on trails		X		
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Design. Introduction of higher level of one user group that wasn't historically as high. Perception of other user groups, which influence interactions.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Post closures by user-type. Have trail etiquette signs on major trails in system.

How successful were the physical response(s)?

It keeps most people on the trails that they are allowed on.

What has been your agency's management response? (i.e., speed limits, citations, exclusion of particular user groups, etc.)

Separation of use, when space allows. Exclusion of use if health, safety or natural resource issue irresolvable. Citation authority available, but used rarely. Engage in multi-user trail meetings to develop plans to meet all users needs.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

OAR 736-010-0020, 8; 736-010-0026, 2; 736-010-0030, 8

How well did you find the management response(s) work?

Biggest success is when we can get users to work together on the solution. This reduces lumping one bad experience with the entire user group, allows relationships to be built and shared successes to be experienced.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Trail design (too steep, poor flow, etc.) appear to create the biggest impact on conflict. When trails are designed sustainably and with multi-users in mind, the conflicts are reduced. Most of our complaints can be linked back to design (using old logging roads for example) which magnify any conflict.

F.4 Regional Agencies

F.4.1 Capital Regional District Parks

Agency contact information

Name of agency:	Capital Regional District Parks
Street address:	490 Atkins Avenue/ Victoria, British Columbia / Canada V9B 2Z8
Name/position of trail manager:	Jeff Ward, Manager of Planning, Resource Management and Development
Phone/e-mail:	250.360.3370 / jward@crd.bc.ca
Responsibility for trail use policy/management:	Responsible for designing, building, and maintaining 30 Regional Parks and three Regional Trails (including
	Lochside, Galloping Goose, E & N Rail Trail

Agency and Trail System Information

Type(s):	Regional
Size (acres managed):	11,500 hectares of 30 Regional Parks, 3 Regional Trails
Trail system length managed:	Approx. 80 km
Trail surface types:	
Trail user types accommodated:	pedestrians, wheelchair users, cyclists, dogs (on & off leash),
Additional resources:	BIKESAFE #36

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

1) Dog management

2) People riding bikes too fast on the regional trails

3) Trail width – not enough room

From which group(s) do these complaints usually come?

1) Non-dog owners. Walkers typically. Complaint is sometimes between two dog owners

2) Pedestrians

3) Cyclists

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

Dogs: Any time. No trends noticed

Cycling: Mostly during peak commuting periods (7-9am, 4-6pm)

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Dogs: No trends noticed

Cycling: Urban sections of trail as they are more heavily used

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)

1) dog-walker – non dog-walker

2) cyclist – pedestrian

3) vehicle – trail user (at road crossings)

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Horseback riders – dog-walkers

Horseback riders – cyclists

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

Not enough data to answer this question.

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Dogs – lack of leash regulations

Community traffic vs. recreational traffic: trail etiquette issues (i.e. cyclists biking two abreast, walkers with headphones, trail users not yielding to other users, etc.)

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Trail etiquette signage is posted at most entrances to the trail. Have painted centerline on trail. Intersection design.

How successful were the physical response(s)?

Moderate – hard to judge as we have no benchmark data with which to measure from.

What has been your agency's management response? (i.e., speed limits, citations, exclusion of particular user groups, etc.)

Park bylaws and regulations; bylaw enforcement; volunteer trail ambassador program aimed at promoting good trail etiquette; volunteer warden program; seasonal regulations for dogs (on beaches in particular); some exclusion of user groups (i.e. no motorized access, no cyclists in places); information on website (i.e. trail etiquette, etc.) and other media outreach

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

Regional Park Regulation Bylaw, Trail Etiquette document; pedal-assist bicycle FAQ, Pets in Parks webpage, Cycling in Regional Parks and Trails webpage

How well did you find the management response(s) work?

Moderate – hard to judge due to lack of benchmark data with which to measure from.

What other responses did your agency try that did not work?

Tried to put leash regulations in park but due to public input, the regulation was lifted.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

We have over 80 kms of Regional Trails in our region with over 2 million users per year. Based on that, the ratio of complaints we receive is very low.

In 2010, we rolled out our Volunteer Trail Ambassador Program – public response for this program has so far been very good.

F.4.2 Conejo Open Space Trails Conservation Agency

Agency contact information

Name of agency:	Conejo Open Space Trails Conservation Agency (COSCA)
Street address:	City Hall/Civic Arts Plaza / 2100 Thousand Oaks Boulevard / Thousand Oaks, CA
	91362
Name/position of contact:	Kristin Foord, Manager
Phone/e-mail:	kfoord@toaks.org or (805) 449-2505.
Responsibility for trail use policy/management:	Preserving, protecting and managing open space resources

Agency and Trail System Information

Size (acres managed):	Over 11,300 acres
Trail system miles managed:	Over 140 miles
Trail user types accommodated:	Hikers, equestrians, mountain bikers
Additional resources:	COSCA Ordinance NO 01 2009

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?(From which groups, related to which other users, etc. We are primarily interested in conflicts between user groups, rather than those involving dogs on- or off-leash.)

The complaints, which are relatively rare overall, are generally from equestrians (most frequently) or hikers (less frequently) complaining that mountain bikers are speeding down the trail and don't yield to them.

The equestrians in particular bemoan the lack of etiquette amongst the young, male mountain bikers; these same people generally do admit that non-"lone male" mountain bikers are often well behaved and do follow trail etiquette.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

On single-track sections, and the concern from equestrians in particular is that mountain bikers speeding around a corner will either hit them on their horse (because they don't have time to move) or that it will scare their horse and will injure either the rider (if thrown), the mountain biker (if kicked), or both.

Does you agency collect or record incidents or complaints?

We do not collect data, as we rarely get complaints. We are very fortunate to have a long history of shared use on our trails (all of our 140 miles of trails except ~1 mile) may be used by hikers, mountain bikers, and equestrians, and a very low rate of conflicts (and to my knowledge, no actual accidents because of these conflicts to date). Most of our trail user complaints (by all groups) are about dogs off leash.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint		x 4x/yr		
Reported Incident			x	
Injury due to collisions				x
Non-injury collision				x unknown
Damage to natural resources		x		
Close calls negatively affect user experience			x	
Congestion or overcrowding on trails				x
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Many of our equestrians are older females who would prefer not to share the trail with mountain bikers because of the speed of the bikes and their perception that mountain bikers don't respect the trails or follow etiquette.

I've heard that they express their displeasure aloud when encountering a non-yielding mountain biker, which perhaps helps the mountain bikers to become more aware of the rules, and results in a self-correcting system

Some hikers have complained that mountain bikes aren't keeping on the trails on a few of the flatter areas, instead creating "more challenging" (illegal) trails alongside the main trail, causing resource damage. We do have many challenging trails available, so we try to put up "revegetation area" signs to stop this use and our Rangers will direct riders to the more challenging areas where they will have less desire to create their own side-trails.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

We do not post speed limit signs, but the trail etiquette symbol is on all of our trail entrance signs. We try to teach trail etiquette to local schoolchildren through skits performed at our "Trails Education Days" annually for 1,500+ 5th graders. We used to give out keychains with the yellow etiquette symbol at public events (no longer, due to budget cuts). We only exclude horses/bikes on a few short trail segments where the trail includes stairs.

How successful were the response(s)?

We have never really had any serious problems, and continue to be very lucky in that regard. We do have a Trails Advisory Committee, composed of three equestrians, three hikers/runners and three mountain bikers, which meets monthly to discuss trail issues. User conflicts are not often a topic of discussion, but the forum does help to build relationships and understanding between the user groups. The Committee members primarily just alert staff about general maintenance issues and all help to manage our volunteer programs. One of those programs is a volunteer Trail Patrol with hiking, mountain biking, and equestrian members.

What design guidelines documents does your agency use?(please provide a link if available online)

We generally USFS or CA State Parks trail standards (for our new/rerouted trails). Some of our older trails are former ranch roads which we are trying to reroute to bring up to standards over time.

What trail policies or management techniques does your agency use?

http://www.conejo-openspace.org/COSCA%20Ordinance%20No.%2001-2009.pdf

What other responses did your agency try that did not work?

We haven't had to try anything since we've been lucky to have so few problems (knock on wood).

In one incident several years ago, one equestrian apparently decided to slow down mountain bikes by digging a hole in the trail just below a downhill switchback as a booby trap for bikers. Her equestrian friends apparently soon convinced her to repair the intentional trail damage and remove the trap. This problem thankfully resolved itself as a result of community peer pressure to share the trail.

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

We have seen fewer and fewer equestrians and more and more mountain bikers over the past ~15 years.

Our trails are very popular with mountain bikers and because we have so many of them now, and fewer equestrians, the equestrians have had to adapt and would not be successful in keeping the mtn. bikers out. It's also possible that because many of our trail users are local residents, there is a sense that they may see the other trail users at the grocery store or will see them again on the trail, so it's a disincentive to misbehave. There may be a better sense of shared community here than in larger trail systems.

Does your agency have a policy or approach to managing "Other Power Driven Mobility Devices" (OPDMD)'s, based on the new Department of Justice ADA Ruling that power-driven vehicles must be permitted on trails unless a safety assessment is completed (35.137)?

Yes, see http://www.conejo-openspace.org/COSCA%20Policy%20on%20OPDMDs%203_11.pdf.

We will be watching for rulings, guidance from the Access Board, or other new interpretations and plan to revise our policy as necessary in the future based on that new information.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Basically all of our trails have been multi-use (hiking/mtn biking/horseback riding) from the time of the agency's founding in 1977. Segregation has not been considered, nor has it been requested by our users in the past. On our Trails Advisory Committee, all three user groups sit around the table together, and at our popular volunteer trail work days, all three user groups work side by side to maintain our trails. The primary local mountain bike shop sells (and encourages customers to buy) bells to tie to the back of mountain bikes to alert other users that the rider is coming down the trail. We have heard that when these bells are used by mtn bikers, the equestrians and hikers are appreciative and thank the bikers.

F.4.3 Front Country Trails Multi-Jurisdictional Task Force

Agency Contact Information

Name of agency:	Front Country Trails Multi-Jurisdictional Task Force
Street address:	187 Paradise Rd, Santa Barbara, CA 93102-1990
Name/position of contact:	Rebecca Mordini, Front Country Trails Coordinator
Phone/e-mail:	805.698.5455 / sbfct1@gmail.com
Responsibility for trail use policy/management:	Coordinate with Park Staff from City and County and Los Padres National Forest on creating and implementing trail management objectives and programs.

Agency and Trail System Information

Type(s):	Regional (City & County of Santa Barbara, the Los Padres National Forest)
Size (acres managed):	
Trail system miles managed:	30 miles of trail
Trail surface types:	narrow, natural surface trails
Trail user types accommodated:	hiker, equestrian, bicyclists, trail runners

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Historical conflict dating back 30 years between bicyclists and the other user groups, hikers and equestrians.

Complaints of speed of downhill bicyclists, near misses between bikes and other users, and horses in fear of encountering bikes on the trial. Fear that the trails are too narrow to allow for safe passing of different user groups in different directions.

Five years ago a bike and a horse were passing each other on a trail and the horse fell over the side and died.

From which group(s) do these complaints usually come?

The Sierra Club has leadership that is vocal about problems with bikes. Individual equestrians also lobby for removing bikes from the trails so that they will be safe for equestrian use.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

There is no formal reporting system for conflict, so we do not have that data.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Based on public comment on this issue, it seems that most conflict occurs where line of sight is impaired and where a steep grade leads to higher bike speeds.

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)

While we do not have data on actual conflict, most complaints at Task Force meetings are received from hikers about the speed of mountain bikes. However, during public education events, we hear mostly about the problems associated with dogs and hikers.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Conflict between equestrians and mountain bikes is also a complaint. Aside from the incident five years ago, we do not have any reported incidents. However, equestrians state they have stopped using the multi-use trials as they do not feel safe knowing that mountain bikes could be approaching. Horses are easily startled by anything un-expected on the trail and this can be a real danger.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

I am sorry we do not have this data.

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Historical Expectations: the trails predate mountain biking, so having bikes on the trails is not the expectation of long-time users. However, bikes have never been banned from the trials, so there is 20 to 30 years of bike use that is also an expectation of the community.

Physical Characteristics: narrow, natural surface trails with average grades of 12% with some areas as steep as 26% and steep drop offs. This creates high speeds for downhill bikes, with some areas that have little space for users to pass each other safely. Brush growth in the summer inhibits line of sight, leading to being surprised by an approaching bike.

Road access at top of the trail: with most of our trails having access to the trailhead from a road at the top of the trial, the trails have become popular with downhill mountain bikes who shuttle to the top and ride down at high speeds. This particular type of riding has exacerbated conflict between bikes and other groups.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Initial education focused on standardized trail etiquette and information signs at trailheads.

Enhanced volunteer engagement in trail maintenance has allowed for better brush clearing and repair of eroded areas of trail. This has lead to better lines of sight and fewer narrow, loose areas of trail.

Standardized trail rehabilitation guidelines have allowed community organizations to take on rehabilitating specific trails for safer equestrian and therefore multi-use access.

How successful were the physical response(s)?

Signs help clarify expected behavior and set the expectation of multi-use, which has been very helpful, especially in reaching those from outside the local community.

Better trail maintenance and rehabilitation is expected to lower the number of actual incidents on the trail. There is no formal reporting system but the feel is that "none to few" actual incidents occurred before and that continues to be the case after our enhanced trail maintenance. This does not impact user expectation.

What has been your agency's management response? (i.e., speed limits, citations, exclusion of particular user groups, etc.)

Creation of a multi-agency Task Force with regular public meetings has been key in giving the public a legitimate place to express their concerns about other trail users. This has lowered overall hostility and served as a catalyst for problem solving. Staff from all three agencies has been able to gather and present best practices in all areas of trail management and user conflict, which helps to put the complaints of certain members into perspective. The Task Force serves as the major educational outreach to help set user expectations for our mulit-use trails.

The bike community, lead by Santa Barbara Mountain bike Trial Volunteers, an IMBA group, has taken the lead in educating bike users on etiquette and in encouraging use of bike bells. The courtesy of our local bike community has been noticed and helped greatly to diminish conflict. This has helped to shift the conversation from "bikes are bad; how do we eliminate them?" to "how do we change the behavior of certain bicyclists?"

Entrenched conflict among long-time users is less affected by these changes than other types of conflict.

How well did you find the management response(s) work?

Anything that addresses user expectation and improves trail courtesy has a positive impact.

What other responses did your agency try that did not work?

A single agency (USFS) community forum worked for several years to resolve these issues and agreed on an odd/even arrangement on one trail as a pilot project. When this arrangement became public knowledge, a backlash from individuals not involved in the process lead to the plan being abandoned. The current Task Force structure assures a completely open process that is accessible at City and County levels as well involving Forest Service personnel.

The agencies have tried to empower a single community group made up of members from all user groups to serve as an umbrella group. The hope would be that the umbrella group would take on trail stewardship and bring user groups together. The political climate in the community has made these efforts fruitless.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

We are still struggling with issues of entrenched conflict, while make progress one conversation at a time. I feel that our biggest challenge is to build trust between groups and to manage user expectations. There is no magic bullet or ideal trail design that resolves these issues, simply an ongoing commitment to our goals of Safety, Sustainability and Satisfaction, with open and respectful communication at all levels.

In particular, what solution or strategy has the above agency used?

My conversations with the Parks and Recreation Trail Management team in Boulder Colorado was very useful. They are building single track for multi-use with a well-structured community process. They are well-funded and use tools to measure their results.

F.4.4 Hill Country Conservancy

Agency Contact Information

Name of agency:	Hill Country Conservancy
Street address:	221 W. 6th St., Austin, Tx. 78701
Name/position of contact:	Butch Smith
Phone/e-mail:	512/328-2481 / butch@hillcountryconservancy.or
Responsibility for trail use policy/management:	planning
	Project manager

Agency and Trail System Information

Type(s):	Regional trails
Size (acres managed):	
Trail system miles managed:	100 or more miles regionally
Trail surface types:	various
Trail user types accommodated:	All but motorized

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts? (From which groups, related to which other users, etc.)

Overcrowded trails bring complaints about bikes and dog walkers.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Most occur in highly urbanized trails, especially around activity areas (non-trail related) where large numbers of park and trail users mix.

Does your agency collect or record incidents or complaints? (If yes, would you be willing to provide us with that information?

Not that I know about.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

No information provided.

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Bike riders go too fast. Dog walkers have trip wire leashes. Social walking groups of 3 or more use the entire trail.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

On the Barton Creek Trail, hikers and bikers are separated in areas of scenic interest so that hikers can relax and look at the setting without having to constantly watch out for bikes. More on-street bike lanes are being developed to take some bike use away from trails.

How successful were the response(s)?

The Barton Creek trails separation has been appreciated. The Lance Armstrong Bikeway, an off-street and on-street path, has been successful.

What design guidelines documents does your agency use?(please provide a link if available online)

Various depending on the type of trail, ranging from ASSHTO to IMBA.

What trail policies or management techniques does your agency use? (please provide a link if available online)

A Trail Ranger Corps is being implemented by the Austin Parks and Recreation Dept.

What other responses did your agency try that did not work?

On the most used trail around Lady Bird Lake in Austin (1.5 million visits per year), there was an attempt to create a parallel trail for bikes only. This did not work out due to land pattern limitations. Basically there was not enough room in a highly developed urban area.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Partnerships between local governmental agencies, user groups and non-profit organizations has improved communication greatly. Each entity does what it can within its realm of influence to improve trail conditions and etiquette.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name:	Nadia Barrera
Agency contact (if available):	Bike / Ped program with the City of Austin
Phone/e-mail:	Nadia.barrera@ci.austin.tx.us

In particular, what solution or strategy has the above agency used?

We are observing and learning from everyone.

F.4.5 Tualatin Hills Park and Recreation District

Agency Contact Information

Name of agency:	Tualatin Hills Park and Recreation District
Street address:	15707 SW Walker Road Beaverton, OR 97006
Name/position of contact:	Brad Hauschild / Park Planner
Phone/e-mail:	503 629 6305 x2931 / bhaus@thprd.org

Agency and Trail System Information

Type(s):	City
Size (acres managed):	1,300 acres of natural areas
Trail system miles managed:	60 miles of trails
Trail surface types:	45 paved, 15 unpaved
Trail user types accommodated:	Walkers, runners, bicycles, wheelchairs, etc. No ATV or other motorized used. Minimal mountain bike usage.

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Users going too fast- mostly bicyclists on paved trails. Occasionally similar complaints about runners. Some complaints about blind corners, being cut off by a bike rider or no announcement that they're coming.

From which group(s) do these complaints usually come?

Walkers seem to complain the most.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

Highest complaint load is during the summer, but we get them at all times of the year. The greatest number of users on our trails is during the weekends with peaks in the spring and early fall.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Bends for sure, or anyplace that has poor visibility. On the other hand some conflicts occur on straigtaways because bikers go too fast.

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)

Road bikers and walkers.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Walker with dogs and those without dogs.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint		X		
Reported Incident			X	
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources			X	
Close calls negatively affect user experience			X	
Congestion or overcrowding on trails			X	
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

The biggest issue is design- no matter how wide the trail is, there tend to be too many different types of users at peak types and a conflict (perceived or real ensues). I think older trail users tend to be more uncomfortable with faster moving users and see that as a threat- so they complain about it even when the usage isn't likely to lead to an accident.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

We gave poseted etiquette signs in some places but they don't tend to work- only law abiding users tend to read them! We have done some pruning of trails to improve visibility. Some of our paved trails are striped like a road. We also have rangers out on trails- they are a reassuring presence and talk to folks when they encounter a situation, which is not often.

How successful were the physical response(s)?

Design changes that influence behavior like stripes or wider trails seem to be the most effective. Signs are useless.

What has been your agency's management response?

We don't give citations, but can exclude certain users for violating rules. We've used this rarely but it can work.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

We can only exclude someone from a trail if they violated a rule in our rule book (www.thprd.org/about/risksafety/rulesregs.cfm)

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name: Portland Parks, Portland OR They have a lot more trails and users than we do.

F.4.6 Vancouver-Clark Parks and Recreation

Agency Contact Information

Name of agency:	Vancouver-Clark Parks and Recreation
Name/position of contact:	Lisa Goorjian / Regional Trail Planner
Phone/e-mail:	(360) 619-1134 / lisa.goorjian@ci.vancouver.wa.us

Agency and Trail System Information

Type(s):	City and County (merged park management responsibilities)
Size (acres managed):	Manages nearly 7,000 acres of parkland
Trail system miles managed:	Over 44 miles of trails. Paved path, Unpaved path, Bicycle Path, Equestrian Trail, Mountain Biking, Hiking
Trail surface types:	Paved, gravel and soft-surface
Trail user types accommodated:	Walkers, bicyclists, equestrians, roller-bladers

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

The nature of most complaints we receive related to user conflicts is regarding pet owners and off-leash dogs.

We also receive limited complaints from walkers and bicyclists saying that the trail width is too narrow.

From which group(s) do these complaints usually come?

Most of the complaints come from pet owners (who keep their pets on leash).

We also receive limited complaints from walkers and bicyclists.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

User conflicts often occur after work in the evenings and in the spring when the majority of trail users return.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Trail user conflicts most frequently occur at trail junctions and narrow sections.

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)

Pet owners on the trail are most commonly involved in conflicts with each other.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Less frequently walkers and bicyclists may sometimes be in conflict with one another.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint			X	
Reported Incident				X
Injury due to collisions				X
Non-injury collision			X	
Damage to natural resources			X	
Close calls negatively affect user experience				X
Congestion or overcrowding on trails			X	
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Design issues include: poor drainage, steep slopes, narrow width, hard to see bollards and curbs

Wet weather conditions on old trail bridges that become very slippery contribute to conflicts and user safety.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Our agency has designated and built some soft surface trails adjacent to paved trails to accommodate, but not for exclusive use by equestrians. We have also installed trail courtesy signs- share the trail triangle and we have proposed installing reflective tape around all bollards within the trail.

How successful were the physical response(s)?

The separated trails and courtesy signage have been successful in addressing some user conflicts. We have not yet implemented reflective tape on all the bollards.

What has been your agency's management response? (i.e., speed limits, citations, exclusion of particular user groups, etc.)

Our agency's management response to user conflicts is to work closely with trail user groups (equestrian groups, hiking groups, etc), citizens and business owners to have them inform and guide their constituents on strategies to minimize user conflicts.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

We do not currently have any trail policy statements, regulations or guidelines to document our management response to user conflict issues (but we'll probably use this memo as a start.)

How well did you find the management response(s) work?

Our agency has found working with trail user groups and interested citizens to assist with reducing trail user conflicts to work well.

What other responses did your agency try that did not work?

Trying to close or regulate sections of trail that had user conflicts did not work and increased trail management issues.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Our agency has been most successful in reducing trail user conflicts by working with the trail groups that use the facility to provide a positive message, role model, expectations, etc. Additionally our agency recognizes that working with trail groups and citizens on trail projects from the planning- through construction and management instills ownership, and mutual respect for all the user groups.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name:	Washington Department of Natural Resources- facilitates TAG Trail Advisory Group for Yacolt Burn Forest
Agency contact (if available):	Jessica Kimmick
Phone/e-mail:	jessica.kimmick@dnr.wa.gov Office number: 360-666-9400

In particular, what solution or strategy has the above agency used?

The best solution and strategy we have employed to address trail user conflicts is to work with trail user groups, citizens, and volunteers

F.5 County Agencies

F.5.1 Jefferson County Open Space

Agency Contact Information

Name of agency:	Jefferson County Open Space, Colorado
Street address:	700 Jefferson County Parkway / Golden, CO 80401
Name/position of contact:	Colleen Gadd, Visitor and Resource Protection Supervisor
Phone/e-mail:	cgadd@jeffco.us / 303-271-5995
Responsibility for trail use policy/management:	Construction, maintenance and management of park and recreation facilities.

Agency and Trail System Information

Type(s):	County
Size (acres managed):	38,761 acres
Trail system miles managed:	204 miles
Trail surface types:	Natural surface, gravel, concrete
Trail user types accommodated:	dogs (leashed), non-motorized, pedestrian, equestrian, bicycling
Additional resources:	Yielding order & passing regulations; American Trails article

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Dogs off leash.

Speed differential usually resulting from mountain bicycle use on downhill trail segments.

From which group(s) do these complaints usually come?

Hikers, equestrians and other bicyclists

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

Conflicts occur at heavy use periods, particularly weekday late afternoons (after work) and weekends.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section of an unpaved trail, etc.)

Unpaved trails in our foothill terrain that include trail bends that are heavy with vegetation or tree lined, narrow trails with limited visibility or wide trails that allow for fast speeds. Dogs off leash complaints occur throughout our parks system.

Which combination of trail users is most commonly involved in conflicts with each other? (i.e., mountain bikers and equestrians, road bicyclists and inline skaters)

Mountain bikers with hikers.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Hikers without dogs and hikers with dogs not on leash

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint	X			
Reported Incident			x	
Injury due to collisions				Unknown – some may not be reported to our agency
Non-injury collision				Unknown – some may not be reported to our agency
Damage to natural resources			x	
Close calls negatively affect user experience	X			
Congestion or overcrowding on trails	X			
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Design sometimes contributes to conflict. Narrow trails and wide trails each have their own challenges. Narrow trails with poor line of sight can cause users to not see one another when approaching at a fast speed and sometimes there is not a lot of room for passing. Wide trails sometimes lend to higher rates of speed which may increase safety concerns as well.

Variety of users types, difference in capabilities and user expectations. From expert riders who want to get a work out to kids and families just on a stroll or leisurely ride. Using the trails as a gym vs using them to enjoy nature.

Perceptions of user groups…a few bad apples have spoiled opinions related to all within the user groups, most particularly toward mountain bicyclists, but other user groups have also had negative perceptions due to the actions of a few.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Jefferson County Open Space, CO has provided some separate trails for hiking only, as well as a hiking only park. We post trail user etiquette, stage special educational events at parks, and in 2009 did extensive user outreach and implemented new management techniques at a high conflict park (Apex Park).

Apex design considerations for trail development and maintenance to reduce speed (and minimize conflict) include: establishing chicane style traffic calming structure of both rock and fencing; creating segregated access trails at trailheads; being thoughtful of vegetation management as it relates to sight distances; and post etiquette signs at both trail heads and strategic locations throughout the trail system.

Additional responses throughout our system have been alternate use days (i.e. bikers on one day and hikers on another), directional travel (mtn. bikes one way on certain days), speed limits at one urban park and on concrete bikeways, educational efforts including our Bike Right and Share the Trail programs and use of volunteer patrollers.

How successful were the physical response(s)?

The alternate use proved to be a successful management response, as did the separate trails. While resistance from user groups was evident at first, satisfaction with the overall management was high with both management actions

At Apex Park, Jefferson County Open Space is in the second year of monitoring compliance and satisfaction of objectives to increase safety for visitors. The program will continue to have specific outreach and enforcement activities at this park to sustain initial improvements. However, initial responses from user groups thus far are showing favorable.

What has been your agency's management response?

To reduce speeds on some trail sections, JCOS implemented an alternating day (odd-days) directional restriction to mountain bicycling over three trail segments as well as constructed additional trail mileage (approx 1 mile) at Apex Park to provide a complete Park experience to all users despite any directional restriction. We are considering "zoning", whereby there may be zones for dismount or posted reduced speeds, although we have not implemented zones at this time. We also developed a new regulation regarding the manner in which users are required to pass one another on trails.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

JCOS documented the rise in safety/incident reports at Apex Park, and responded to the situation by engaging the park users in developing alternatives and management made the decision to implement the alternating day directional restriction to bicyclists at Apex Park. The visitor thus had the opportunity to select trails and anticipate from where a faster user might come on the odd days. The management technique did not prohibit any user type from accessing the park at any time.

How well did you find the management response(s) work?

For Apex Park, Jefferson County Open Space is in the second year of monitoring compliance and satisfaction of objectives to increase safety for visitors. The program will continue to have specific outreach and enforcement activities at this park to sustain initial improvements.

Other favorable outcomes of different management actions are noted in b. and other areas.

What other responses did your agency try that did not work?

Before engaging user groups and developing management options, staff had used educational special events and increased patrol to help with conflict issues. These outreach efforts didn't result in the behavioral changes necessary to address safety by some of the faster users.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Before implementing alternating day, directional restrictions for mountain bicyclists at Apex Park, Jefferson County Open Space experienced reduced user conflict at one of the newer parks in the system, Centennial Cone Park. During the planning and public input phase at Centennial Cone Park, the option of alternating weekend day use by hikers and mountain bikers was a new concept for the program that had largely been a multiple non-motorized use system. Initiated in 2006, alternating weekend days by hikers and mountain bikers has been adopted as a viable technique for user management.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name: Jefferson County Open Space, Golden, CO

In particular, what solution or strategy has the above agency used?

Alternating Weekend Day access at Centennial Cone Park in Jefferson County, CO.

F.5.2 Mecklenburg County Park and Recreation

Agency Contact Information

Name of agency:	Mecklenburg County Park and Recreation
Street address:	5841 Brookshire Blvd., Charlotte NC 28216
Name/position of contact:	Michael Kirschman / Division Director, Nature Preserves & Natural Resources (natural surface trails), Jeff Robinson/Division Director, Park Operations & Athletic Services (paved greenway trail maintenance), Gwen Cook, Greenway Planner (greenway planning & design)
Phone/e-mail:	(704) 336-3854 Michael.Kirschman@MecklenburgCountyNC.gov
Responsibility for trail use policy/management:	Planning, design, some construction (most bid to outside contractors, although some built in-house), maintenance and management
	Policies associated w/ the various trails are contained in the Mecklenburg County Park & Recreation Facilities Ordinance and the approved Nature Preserves Master Plan

Agency and Trail System Information

Type(s):	Parklands designated by usage/type. Designations include Neighborhood Parks, Community Parks, Regional Parks, Greenways, Nature Preserves, and Special Facilities (ex: golf courses, aquatic center, stadium, etc.). Greenways are linear parks typically following streams/floodplains with paved trails. Over 33 miles built to date. Nature Preserves contain 35 miles of natural surface trails through woodlands and prairies. In the active Regional/Community Parks, there are 7 mt. biking trails totaling 44.75 miles.
Size (acres managed):	The Mecklenburg County Park & Recreation Department is home to 210 parks and facilities located on more than 18,800 acres of parkland throughout Mecklenburg County.
Trail system miles managed:	There are 33 miles of developed paved Greenway trails in Mecklenburg County (147 miles planned). There are 35 miles of natural surface trail in the established parks designated as Nature Preserves. There are nearly 45 miles of separate natural surface single track mt. biking trails.
Trail surface types:	Paved asphalt, some crushed gravel greenway trails, boardwalks, and natural surface/dirt trails in the preserves and at the mt. biking trails.
Trail user types accommodated:	Greenways – permit all users except motorized vehicles and horses. This includes hikers/walkers, runners, bikers, rollerblades, etc. (no equestrian use, no segways, no golf carts or other vehicles permitted) Natural Surface Trails – walking/hiking/running only. No bikes permitted. No vehicles permitted. Equestrian trails (shared with hikers) at one preserve – Latta Plantation Nature Preserve. Mt Bike Trails – bikers only.

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?
Regarding paved greenway trails, trail users not using good judgment and/or breaking rules (ex: going too fast on bikes, dogs off leash, etc.)

For the natural surface nature preserve trails, horse droppings on trail (at Latta Plantation Nature Preserve, the only preserve that permits equestrian use) and dogs off leash (similar to greenway trails).

Again for Latta, horse riders riding too fast and/or horse on non-horse/hiking only trails.

From which group(s) do these complaints usually come?
Mostly from park visitors walking the greenways, or from trail hikers and trail runners using the natural surface nature preserve trails.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)
All time, but more often weekends, and more often from March thru October (our "peak" season in terms of visitation and usage). Greenway trails experience more conflicts after 5pm and on the weekends (high usage times).

Where do trail user conflicts most frequently occur?
Regardless of trail section or design, conflicts occur throughout the system and mainly on the most heavily used and crowded sections/segments of trail.

Which combination of trail users is most commonly involved in conflicts with each other?
On paved greenways, bicyclists and walkers, or bicyclists and runners.

On natural surface nature preserve trails, equestrian riders and hikers (at Latta only), dog walkers and hikers, dog walkers and other dog walkers.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?
Horse rider to horse rider (Latta only)

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')
Unable to provide accurate information – these are "best guesses"

	Weekly	Monthly	Annually	Less than once a year
Complaint		X		
Reported Incident		X		
Injury due to collisions			X	
Non-injury collision	X			
Damage to natural resources			X	
Close calls negatively affect user experience		X		
Congestion or overcrowding on trails		X		

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?
Main condition is too many users/heavy trail use at one time. Other conditions mainly related to safety are due to weather conditions such as rains that bring creek levels above trail surface, depositing mud, sediment and debris along the trails.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Separate trails for separate users has worked well, and is likely responsible for the low amount of issues we experience. As stated, no biking on natural surface nature trails. There are separate mt. biking trails. Also, no equestrian trails throughout the system, except at one location where it was grandfathered (the only place we have equestrian conflicts). The entire department master plan, which contains the nature preserve master plan (which outlines permitted uses) can be found at http://charmeck.org/mecklenburg/county/ParkandRec/InsideTheDepartment/Divisions/ParkPlanning/Pages/10YrPlan.aspx

If trail design was/is an issue, typically those are addressed as possible/practical. For problems related to improper trail use, additional rule/regulation signage is posted (mixed results on effectiveness, but necessary), and patrols and monitoring is sometimes increased. In some cases, off-duty police are scheduled to work sections of greenway trails where problems are more frequent.

Due to popularity of greenway trails, trail widths increased (standard width is now 10 feet, whereas some of the original paved trails were smaller)

How successful were the physical response(s)?

Moderately successful

What has been your agency's management response?
(i.e., speed limits, citations, exclusion of particular user groups, etc.)

Increase monitoring, enforcement of rules/regulations, increased communication with user groups

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What trail policy statements, regulations, guidelines, etc. do you have to document the response?

The department has a Park Ordinance document that addresses all rules and regulations for use in the parks, on the trails, and on any county property.

How well did you find the management response(s) work?

Moderate

What other responses did your agency try that did not work?

All worked to some degree. Definitely the best practice has been to segregate users/trails, and try to stay away from mixed use trails.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name: Forest Preserve Districts in Illinois (ex: Kane County, DuPage County, Will County, Cook County)

In particular, what solution or strategy has the above agency used?

I'm aware that at least one district (Kane County I believe) opened up entire forest preserves as "off leash" preserves. Meaning at those preserves individuals can let their dogs run off leash through the entire property, and anyone visiting the preserve should simply expect to have contact w/ off leash dogs. A unique way to provide "off leash areas" as opposed to fenced dog parks or requiring pets to be leashed. Unsure how successful this has been. It has been 5 years since I lived in IL.

F.5.3 Sacramento County Regional Parks, Recreation & Open Space

Agency Contact Information

Name of agency:	Sacramento County Regional Parks
Street address:	700 H Street, Room 7650 / Sacramento, CA 95814
Name/position of contact:	Kathleen Utley, Chief Ranger
Phone/e-mail:	916.876.3030 / utleyk@saccounty.net

Agency and Trail System Information

Type(s):	County
Size (acres managed):	15,000 acres
Trail system miles managed:	23 miles (American River Parkway)
Trail surface types:	Paved, unpaved
Trail user types accommodated:	Hikers, pedestrians, MTBs, equestrians, dogs (on leash)
Additional resources:	American River Parkway Plan; Bike Trail Rules & Regulations; Sacramento County Parks Ordinance (2008)

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Our most frequent complaint is speeding groups of bicyclists that yell at slower more family oriented groups.

Several of our user groups use the trail for endurance training. They usually want to go faster than the posted speed limit of 15 mph.

Where do trail user conflicts most frequently occur?

These conflicts conflict occur most frequently on weekends and in the section of trail that goes from Watt Ave. to Hazel Access. It is generally not associated with any particular bend or narrowing.

Does you agency collect or record incidents or complaints?

We keep accident reports which would have to be released by our Risk Management Office.

We are dispatched thru the Sheriff's Department. They would have a record of every call, but I am not familiar with their policy for releasing those stats.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint			x		
Reported Incident				x	
Injury due to collisions				x	
Non-injury collision			x		
Damage to natural resources			x		
Close calls negatively affect user experience			x		
Congestion or overcrowding on trails		x			
Other (Please Specify)					

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

We have reached our carrying capacity on our trail on weekends. As stated before we have two types of user, the recreation/family users and those that are using the trail for physical training and endurance.

Responses to Trail User Conflicts

What have been your agency's responses?

15 mph speed limit; posted trail rules (Policy 5.14 & 8.25); exclusion of uses (Policy 5.14 & 5.16); separated pedestrian, equestrian/hiker, and bicyclist trails run the length of the American River Parkway (Policy 5.3 & 8.10);

How successful were the response(s)?

We still have some conflicts when users ignore the rules and regulations governing the trail.

Does your agency use other design guidelines documents in addition to the American River Parkway Plan (2008)?(please provide a link if available online)

Sacramento County Codes starting in section 9.36.066 (http://qcode.us/codes/sacramentocounty/)

Do you enforce the 15 mph speed limit? If so, how and how successful has that been?

Prior to the 2009 Budget Cuts we were able to use Rangers on motorcycles to enforce the limit. We have not been able to do any regular enforcement since those cuts.

What other responses did your agency try that did not work?

Placing a radar unit along the trail. This just served to encourage bicyclist to see how fast they could go.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

This is an ongoing issue.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name: Sacramento County Department of Regional Parks, Park Ranger Unit

In particular, what solution or strategy has the above agency used?

The use of the motorcycles was very effective. They could pace the large group and talk to them with little impact to other users.

F.5.4 San Luis Obispo County

Agency Contact Information

Name of agency:	San Luis Obispo County Parks
Street address:	1087 Santa Rosa Street / San Luis Obispo, CA 93408
Name/position of contact:	Ernie Del Rio, Parks Superintendent
Phone/e-mail:	805.781.5930 / edelrio@co.slo.ca.us

Agency and Trail System Information

Type(s):	County
Size (acres managed):	15,000 acres
Trail system miles managed:	52
Trail surface types:	7 Paved & 45 unpaved
Trail user types accommodated:	Hikers, bicyclists (road & MTB), equestrians, dogs

Documenting the Problem

What is the nature of most of the complaints you have received related to user conflicts?

Trespass issues., dogs off leash , dog feces on trails

From which group(s) do these complaints usually come?

Private property owners for trespass issues and hikers complain about equestrians who let their dogs run free

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

All year round, but increases during peak season April through September

Where do trail user conflicts most frequently occur?

Mid trail

Which combination of trail users is most commonly involved in conflicts with each other?

Hikers verses equestrians

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Bicycles verses hikers on the paved trails.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint				
Reported Incident				
Injury due to collisions			2	
Non-injury collision				
Damage to natural resources			3	
Close calls negatively affect user experience				
Congestion or overcrowding on trails				
Other (Please Specify)			4	Conflicts with wildlife

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Congestion and open space

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Inform and educate.

How successful were the physical response(s)?

Limited, honest people respond. Others don't

What has been your agency's management response?

Inform and educate. Has been positive.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

Incident reports and supervisors investigation reports

How well did you find the management response(s) work?

Limited success

What other responses did your agency try that did not work?

Tried to get law enforcement involved with limited response. Offense must be committed in their presence.

In particular, what solution or strategy has the above agency used?

Mutt mitts, signs with ordinances listed.

Santa Clara County Parks and Recreation

Agency Contact Information

Name of agency:	Santa Clara County Parks
Street address:	298 Garden Hill Drive / Los Gatos, CA 95032
Name/position of contact:	Donald Rocha, Natural Resource Program Supervisor
Phone/e-mail:	408.846.5892 / don.rocha@prk.sccgov.org

Agency and Trail System Information

Type(s):	County
Size (acres managed):	45,000 acres
Trail system miles managed:	300 miles
Trail surface types:	Paved & unpaved
Trail user types accommodated:	Hikers, pedestrians, equestrians, bicycles/MTBs, dogs (on leash)

Documenting the Problem

What is the nature of most of the complaints you have received related to user conflicts?

Equestrian and mountain bike use. Although complaints are perceived conflicts with very few reported incidents or actual conflicts.

From which group(s) do these complaints usually come?

Equestrian community.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

Complaints are spring/summer, day use hours on weekends, when parks are more frequently used.

Where do trail user conflicts most frequently occur?

Complaints typically come to Parks from park user comment cards and during planning efforts/public meetings.

The complaints are more general with little detail as to the circumstances.

Which combination of trail users is most commonly involved in conflicts with each other?

Mountain bikes are equestrian and road bikes with walkers/strollers on paved trails.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Road bikes and walker/strollers, mountain bikers and hikers (less frequent conflict, but we do receive reports of mountain bikers traveling too fast and little warning to hikers.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint			X	
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources		Seasonal		
Close calls negatively affect user experience			X	
Congestion or overcrowding on trails			X	
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Mainly related to design and trail grades contributing to speed and visibility.

Responses to Trail User Conflicts

What has been your agency's physical response? (i.e., separate trails for different users, posting of trail etiquette, tight turns, etc.) Do you have any documentation you can provide?

Investigation, enforcement and education. Additionally, we may perform maintenance to improve sight lines and visibility (at times, these are due to deferred maintenance due to staffing and resources). During implementation of a trail construction project we design trails to accommodate multi-use (sight lines, control speeds with grade changes, etc.).

How successful were the physical response(s)?

Outreach and education by Operations staff is well received, although our main conflicts are perceptions and not substantiated by reports or incidents.

What has been your agency's management response?

Outreach and education, as well as enforcement. We have posted speed limits and park rangers enforce those with radar (typically targeted areas from complaints).

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

County wide trails master plan and multi jurisdictional guidelines document (found on County Parks website: www.parkhere.org)

How well did you find the management response(s) work?

Design and construction responses work real well. Response to perception of a conflict is political and hard to track success

What other responses did your agency try that did not work?

N/A

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

The best solutions are design and layout. We have constructed trails with grade changes whereby you reach a ridge nose as an uphill at either direction (as the ridge nose is poor sight line feature). This also works for trail intersections.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name:	Santa Clara County Parks
Agency contact (if available):	Greg Bringelson, Senior Park Maintenance-Trail Crew
Phone/e-mail:	408-629-9347 / greg.bringelson@prk.sccgov.org

F.5.5 Wake County Parks, Recreation and Open Space

Agency Contact Information

Name of agency:	Wake County Parks, Recreation and Open Space
Street address:	1400 Aviation Pkwy. Morrisville, NC 27560
Name/position of contact:	Drew Cade / Manager Lake Crabtree County Park
Phone/e-mail:	919 460 3396 / Drew.Cade@wakegov.com
Responsibility for trail use policy/management:	Act as steward for trail resources, guide maintenance and trail renovation efforts of supporting club- Triangle Off Road Cyclists (TORC).

Agency and Trail System Information

Type(s):	Multi- use- hiking , mountain biking, running
Size (acres managed):	250
Trail system miles managed:	14
Trail surface types:	Mineral surface with some ABC stone armoring and wood bridges
Trail user types accommodated:	hiking , mountain biking, running
Additional resources:	Park also has 520 flood control/ recreational lake attached

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Some hiker/ biking conflicts- mainly due to the volume of mountain biking. Next would be biking to biking conflicts- mostly right of way, speed issues

Where do trail user conflicts most frequently occur?

Most are on long hills, but there is some on blind turns and intersections as well.

Does your agency collect or record incidents or complaints?

We do not collect and collate complaints only incidents involving injuries, most of these are not the result of user conflicts

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint			x		
Reported Incident				x	
Injury due to collisions					x
Non-injury collision				x	
Damage to natural resources			x		
Close calls negatively affect user experience			x		
Congestion or overcrowding on trails		x			

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Again volume drives most of these issues and the fact that the trails are designed by the mountain biking community. There are some design flaws which are being rectified as the IMBA guidelines are implemented in trail renovations. Hikers certainly think the mountain bikers are travelling too fast, but most seem to understand that biking is dominant sector represented on our trails.

Responses to Trail User Conflicts

What has been your agency's response?

We now try and design speed chokes in the trails and several key intersections are triangular to ease flow in/ out and minimize collisions. We also post signs indicating standard right of way- "cyclists yield to hikers", etc…"downhill yields to uphill"l.

How successful were the response(s)?

Given the volume of mountain biking trips- over 100,000 per yr, I would say the response has been positive for the most part.

What design guidelines documents does your agency use?(please provide a link if available online)

We do have a park use agreement with TORC- it is not online, but I can send with survey.

What trail policies or management techniques does your agency use?

The main management tool is closing trails due to wet conditions- again volume dictates that we do this to preserve the trail surface even if designed to optimal standards. The other tool is certainly abiding by the IMBA trail construction standards for all new work completed

What other responses did your agency try that did not work?

Some of our lake trail is in flat, flood prone areas. We have closed this section to mountain biking.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Several rogue trails in the area were built by the freeride, dirt jumping sector of the sport. The park now has a pump track and jump lines so the need is now met in a public park as opposed to on private land without the owner's permission.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name: NC State Parks –Lake Norman St. Park

In particular, what solution or strategy has the above agency used?

Not positive how the park funnels/ filters users, but it is one of the only State Parks to permit mountain biking in North Carolina. Definitely worth checking into.

F.6 Local Agencies

F.6.1 Town of Crested Butte

Agency Contact Information

Name of agency:	Town of Crested Butte, Colorado
Street address:	507 Maroon Ave CB, CO 81224
Name/position of contact:	Jake Jones
Phone/e-mail:	970-349-5338
Responsibility for trail use policy/management:	Trails within jurisdiction and on conservation easements held by Town

Agency and Trail System Information

Type(s):	Range from natural surface single track to paved multi use
Trail system miles managed:	20+
Trail surface types:	Range from natural surface single track to paved multi use
Trail user types accommodated:	All non-motorized including hiker, horse, mtb and hand cycles

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

User conflicts are actually pretty rare. Most conflicts arise around the desire for "hiker only" trails close to town. Crested Butte is a mountain bike mecca and zero trails on our system restrict mountain bikes outside of Wilderness. Hikers would like a non-Wilderness hiker only trail. A couple areas do not allow dogs. Big problem for many people. No strict leach laws outside of Wilderness. Where there are leash requirements on trails, they get ignored. This is a problem for some land owners and non dog lovers.

Where do trail user conflicts most frequently occur?

No place in particular given the nature of conflicts that we have.

Does your agency collect or record incidents or complaints?

No we don't. We monitor open space and deal with violations of Conservation Easements, but we don't exactly record complaints. We have very active mountain bike and hiking clubs that do a lot of self-policing.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint					X
Reported Incident					X
Injury due to collisions					X
Non-injury collision					X
Damage to natural resources			X		

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Close calls negatively affect user experience					X
Congestion or overcrowding on trails		X			
Other (Please Specify)					

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Our biggest problem is lots of use/overuse of some trails. We need better signage for out of town visitors and maintenance is mostly done through stewardship orgs such as the mtb club or the local land trust.

Responses to Trail User Conflicts

What has been your agency's response?

Signage and trail design mostly.

How successful were the response(s)?

Very successful.

What design guidelines documents does your agency use?(please provide a link if available online)

We have trail design guidelines created by Greenways Inc as a part of a recently completed Parks and Recreation Master Plan. The plan is available online and attached to this email.

What trail policies or management techniques does your agency use?

We work in partnership with the local land trust and land owners on the trail system. Each parcel of land and easement language is different, so there is not one single policy or management tool that is applied to all. We have requirements for developers to provide trails in our subdivision regulations.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

I think the major assets to our trail systems is that 1) mountain bikes rule, 2) hikers and horses have lots of places to go to avoid bikes. We are a small town surrounded by public land including a couple Wilderness Areas, so everyone has plenty of room to move. Unlike a smaller park or urban area, we don't have a lot of user conflicts. The Crested Butte community is crazy about trails and no one wants to jeopardize access. Our trail work days can attract 150+ people for a community of around 4000 (if it is a mountain bike trail).

City of Durango

Agency Contact Information

Name of agency:	City of Durango
Street address:	949 E. Second Avenue
Name/position of contact:	Cathy Metz, Parks and Recreation Director
Phone/e-mail:	(970) 375-7329 metzcl@ci.durango.co.us
Responsibility for trail use policy/management:	Oversight of special event permits for trail use; maintenance of trail system
	Establish policy and management

Agency and Trail System Information

Size (acres managed):	2245 acres of open space; 286 acres of parks
Trail system miles managed:	Estimated 95 miles total (83 miles natural surface, 12 miles hard surface)
Trail surface types:	Dirt trails; concrete and asphalt hard surface trails
Trail user types accommodated:	Mountain and road bicyclists, walkers, hikers, joggers, roller bladders, skate boarders (non-motorized uses)

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Primary complaints relates to pedestrians and bicyclists, with pedestrians expressing concern about the speed of travel of the bicyclist and startling the pedestrian when passing.

Complaint from pedestrians that bicyclists do not yield to their use on the trail.

Where do trail user conflicts most frequently occur?

Most conflicts occur on the hard surface primary trail system (Animas River Trail) due to the high utilization. Conflicts tend to occur where there is a reduced site distance.

Natural surface trail conflicts typically occur on a narrow section of trail with reduced site distance.

Does your agency collect or record incidents or complaints? (If yes, would you be willing to provide us with that information?

No permanent record is kept by the City on trail user conflicts.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint			X		
Reported Incident				X	
Injury due to collisions					X
Non-injury collision					X

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Damage to natural resources		X			
Close calls negatively affect user experience			X		
Congestion / overcrowding	X				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?
High use of the trail system by bicyclists and pedestrians; lack of understanding by some trail users of appropriate trail etiquette.

Responses to Trail User Conflicts

What has been your agency's response?
Redesign and reconstruct hard surface trails with poor site distance and known hazards.

Public education and outreach on trail etiquette, with local trail advocacy group (Trails 2000).

Enforcement by Park Rangers and Police officers.

How successful were the response(s)?
Successful on the reconstruction of hazardous area on the hard surface trail. Education and enforcement is ongoing, with some success.

What design guidelines documents does your agency use?(please provide a link if available online)
City standards in additional to applicable state and federal standards. (AASHTO and IMBA)

What trail policies or management techniques does your agency use?
Share the trail etiquette and leave no trace.

What other responses did your agency try that did not work?
Education on bikers yielding to pedestrians on the trail.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?
The City works closely with the local Trails 2000 group on planning, design, construction and management of trail user conflicts. This joint effort has been extremely beneficial to the community.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?
Agency name: Trails 2000
Agency contact (if available): Mary Monroe, Executive Director
Phone/e-mail: (970) 259-4682 mary@trails2000.org

In particular, what solution or strategy has the above agency used?
Organizes volunteers to construct and maintain the natural surface trail system. Maintains a current database of volunteers for education about trail use and etiquette.

F.6.2 City of Henderson

Agency Contact Information

Name of agency:	City of Henderson
Street address:	240 Water Street, Henderson Nevada
Name/position of contact:	Patricia Ayala Park Project Manager
Phone/e-mail:	patricia.ayala@cityofhenderson.com
Responsibility for trail use policy/management:	Planning and Design

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Unleashed dogs, dog waste in trail areas, lights out urban areas, graffiti , debris on trails (rocks, leaves), user conflicts because leashed dogs are taking up entire trail, Cyclist and dog walkers, cyclists riding too fast on multi-use trails, bollards hinder cyclists.

Where do trail user conflicts most frequently occur?

Bike riders going too fast – Under crossings and on grades.

Busy areas near parks, trailhead, recreation centers and neighborhood access areas have conflicts due to high use and multiple user groups

Does your agency collect or record incidents or complaints?

Trail Watch Volunteer program, Tracked only for the purpose of resolution only. These are not published therefore not available.

Formal concerns, requests or complaints are also entered (staff or citizen access) through a Contact Henderson.

This information is not available. .

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint	X				
Reported Incident			X		
Injury due to collisions					X
Non-injury collision				X	
Damage to natural resources				X	
Close calls negatively affect user experience			X		
Congestion or overcrowding on trails		?	X		

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

High use conditions create conflicts between many user groups. Interactions between dog owners and other users. Cycling groups taking over full trail conflict with recreation users. (speed, area,)

Responses to Trail User Conflicts

What has been your agency's response?

Trail and park rules are posted at all major access areas, exclusion of equestrian or separate, parallel equestrian trails, design for exclusion of user groups (rugged hiking trails, mountain biking trails) design to exclude vehicular/ATV groups. Enforcement include the volunteer Trail Watch Group, Henderson Police Public Outreach with ATV groups. Trail Days for educational purposes, public outreach with community groups (HOA's,. Community meetings, etc)

How successful were the response(s)?

HPD outreach successful to reduce illegal ATV. Increased uses reduced many conflicts.

What design guidelines documents does your agency use?(please provide a link if available online)

ADA where applicable, and Federal Standards for accessibility, AASHTO design Standards.

What trail policies or management techniques does your agency use?

Trail rules are posted, Trail Watch volunteers monitor trail use (Volunteer Hours exceed 2500)

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Trail Watch program is very successful, provides a sense of ownership, keeps the "good" users with "eyes" or casual observation (a CPTED concept) at a high level.

Volunteers are provided training, and have been known to provide further casual education to other trail users.

F.6.3 Town of Pagosa Springs

Agency Contact Information

Name of agency:	Town of Pagosa Springs
Street address:	551 Hot Springs Boulevard
Name/position of contact:	Tom Carosello/Parks and Recreation Director
Phone/e-mail:	(970) 264-4151 Ext. 232 tcarosello@centurytel.net
Responsibility for trail use policy/management:	Policy development and implementation, trail maintenance and monitoring.

Agency and Trail System Information

Type(s):	Hiking footpath, unpaved multi-use, paved multi-use
Size (acres managed):	Approximately 200
Trail system miles managed:	6 miles of "ground trail" plus 1 mile of river "trail" (paddlers, rafters, etc.) through downtown
Trail surface types:	Earthen path, asphalt and concrete walkways, river
Trail user types accommodated:	Pedestrian, bicycle/mountain bike and equestrian, rollerbladers

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Nearly all of the complaints we have received involved either pedestrian vs. equestrian conflicts or pedestrian vs. bicycle conflicts, and these have all been on the unpaved, multi-use portions of our trails. On rare occasions, we get a pedestrian vs. equestrian conflict, but less than twice per year. We have received very few complaints resulting from conflict on our paved or concrete trails, and these have always been pedestrian vs. bicycle conflicts or pedestrian vs. unauthorized motor vehicles (scooters, ATV's, etc.).

Where do trail user conflicts most frequently occur?

Our conflicts occur most frequently on "blind" or "short-sighted" curves on our unpaved, multi-use trails, primarily on Reservoir Hill, a 90-acre primitive park within town limits which experiences heavy pedestrian, equestrian and mountain bike use from late spring through early fall. Since the park is heavily forested, nearly every tight bend includes some sight obstructions, and collisions are most apt to occur at these locations.

Does your agency collect or record incidents or complaints?

We only log incidents involve injuries and have not recorded any within the last five years.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Complaint			X		
Reported Incident			X		
Injury due to collisions					X
Non-injury collision				X	

	More than once per week	One per week	Once per month	Once per year	Less than once per year
Damage to natural resources				X	
Close calls negatively affect user experience			X		
Congestion or overcrowding on trails				X	
Other (Please Specify) Unauthorized motor travel			X		

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Most conflicts on our paved or concrete paths involve ignorance of the trail rules. For example, our town is heavily tourist-oriented, and some visitors assume the trails are suitable for scooters, ATV's or, rarely, even cars and trucks. For the most part, however, our conflicts stem from the use of our heavily-wooded, earthen trail system. During the summer, these trails are so thick with foliage that clear lines of sight exist only on long straight-aways, so there is the occasional collision or near collision on bends and switchbacks. Also, until recently, most of the trails in this area were not professionally designed/planned, so as user groups grow, there is inevitably the "discovery" that what was once considered an acceptable trail route or design does not meet current needs or standards with regard to use and safety.

Responses to Trail User Conflicts

What has been your agency's response?

We have posted "warning signs" indicating that the unpaved trails are subject to use by pedestrians, equestrians and mountain bikers, and we have also recently begun to thin some of the dense undergrowth which limits sight distance on some of the "curvier" trails. In addition, we are also currently examining the possibility of designating some of the trails "equestrian only" and "pedestrian only" to limit conflicts. With regard to our paved surfaces, there are postings at each access point indicating trail rules, permissions, etc. For example, all trailheads are marked with "Yield To Pedestrians" signs. In addition, all new trails are planned with the assistance of professionals who specialize in this area.

How successful were the response(s)?

In most instances, the signage and thinning of overgrowth has been sufficient on unpaved trails; conflicts involving injuries have dropped to less than one per year over the past five years.

What design guidelines documents does your agency use?(please provide a link if available online)

In general, we use the recommendations from the National Trails Training Partnership, with some local "tweaking" to accommodate our town codes, trails plan, etc.

What trail policies or management techniques does your agency use?

Same as above, please refer to the link below: www.americantrails.org/resources/trailbuilding/index.html

What other responses did your agency try that did not work?

A few years ago, at the suggestion of a trails-study committee, we tried to limit uses of the unpaved trails, especially equestrian use and mountain bike use, to certain hours of the day. This was a miserable failure.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Recently, we have learned that constructing "parallel" trails for pedestrians and equestrians works quite well where feasible. Even a small buffer zone between the two trails almost entirely prevents conflict, provided each user group is aware of their respective trail guidelines and rules.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name:	Pagosa Area Trails Council
Agency contact (if available):	John Applegate, if he is still involved.
Phone/e-mail:	(970) 731-9325

In particular, what solution or strategy has the above agency used?

I'm not exactly sure of the particulars, but the Pagosa Area Trails Council has been heavily involved in trail construction, maintenance and planning. In fact, the council is more experienced with trails, especially earthen trails, than my department due to the fact that the council services a significantly larger usage area.

F.6.4 City of Palo Alto Open Space & Parks

Agency Contact Information

Name of agency:	City of Palo Alto Open Space & Parks
Street address:	1305 Middlefield Road / Palo Alto CA 94301
Name/position of contact:	Lester Hodgins, Supervising Ranger
Phone/e-mail:	Lester.Hodgins@cityofpaloalto.org

Agency and Trail System Information

Size (acres managed):	4500
Trail system miles managed:	45+ miles
Trail user types accommodated:	Hiking, biking, and horseback riding
Additional resources:	Two small lakes, camping, fishing.

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails ?

Very few complaints, of those we receive it usually bicyclists vs. hikers in relation to speed differential or line of sight.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

Narrow sections of trails.

Does you agency collect or record incidents or complaints?

Have so few we do not track data.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint			x	
Reported Incident				x
Injury due to collisions				x
Non-injury collision				x
Damage to natural resources			x	
Close calls negatively affect user experience				x
Congestion or overcrowding on trails				x
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Design issues, where trails are narrow or sight line is poor and or vegetation growth narrows trails or visibility. These conflicts are typically between bikes and hikers.

Responses to Trail User Conflicts

What has been your agency's response?

We do post trail etiquette and speed / passing limits. Use social media to alert user groups to trail conditions, hazards, and safety concerns. Have also modified trails over time to improve safety e.g. widen for visibility, change grade and surface for speed control.

How successful were the response(s)?

Typically well received. Social media effective for regular /frequent user groups (e.g. biking clubs)

What design guidelines documents does your agency use?(please provide a link if available online)

Trail Master Plan (2001) developed for the Pearson-Arastradero Preserve and the Foothills Park Trails Maintenance Plan (2002) (Sorry, neither are on line)

Both Plans were prepared with Amphion Environmental, Inc and Thomas Reid Associates.

What trail policies or management techniques does your agency use?

Policies and ordinances established by City council (Park Regulations link attached)

Guidelines and techniques also developed in the above mentioned Master / Maintenance Plans

What other responses did your agency try that did not work?

So far no problems.

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

In the development of the Pearson-Arastradero Preserve's Trail Master Plan user groups participated in development of preserves multi use trials in facilitated meetings and trail visits. We maintain contacts and communications with local user groups and use social media to keep user groups informed of any issues.

Does your agency have a policy or approach to managing "Other Power Driven Mobility Devices" (OPDMD)'s, based on the new Department of Justice ADA Ruling that power-driven vehicles must be permitted on trails unless a safety assessment is completed (35.137)?

No not yet!

F.6.5 Portland Parks and Recreation

Agency Contact Information

Name of agency:	Portland Parks and Recreation
Street address:	1120 SW 5th Ave, Portland, OR 97204
Name/position of contact:	Emily Roth / Planner
Phone/e-mail:	(503) 823-9225 / emily.roth@portlandoregon.gov
Responsibility for trail use policy/management:	Planning and policy for natural area trails and some regional, paved trails

Agency and Trail System Information

Type(s):	City
Size (acres managed):	Portland Parks & Recreation is the steward of 11,000 acres of land at more than 250 locations including a multitude of community and neighborhood parks, natural areas, recreational facilities, gardens, and trails
Trail system miles managed:	Single and multi-use trails. Portland has a projected 220 miles of regional trails.
Trail surface types:	Range from soft surface to paved.
Trail user types accommodated:	Single use trails include hiking, walking, exercise/fitness, biking, mountain biking. Multi-use include hiking and mountain biking, hiking and equestrian, walking and biking, walking, biking and equestrian, fire and maintenance
Additional resources:	PP&R Trail Guidelines (2009) & Recreational Trail Strategy (2006)

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Dogs off leash and bags of waste bags left on trails; bikes on walking and hiking trails; high speed users/bike commuters with walkers and others going a slower pace

From which group(s) do these complaints usually come?

Walker/hikers/families

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

All days, all daylight hours

Where do trail user conflicts most frequently occur?

Trails that are too narrow for all the allowed uses

Which combination of trail users is most commonly involved in conflicts with each other?

Road bicyclists that are commuting or training and walkers; runners and dog walkers (dog off leash) on soft surface trails, mountain bikers and hikers

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Dog off leash users with everyone.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint	X			
Reported Incident	X			
Injury due to collisions				X
Non-injury collision			X	
Damage to natural resources	X			
Close calls negatively affect user experience	X			
Congestion or overcrowding on trails	X			
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Off trail use by dog walkers, hikers, mountain bikers

Off leash dogs and runners;

Trails too narrow for the allowed uses and number of people using them

Responses to Trail User Conflicts

What has been your agency's physical response?

Post Trail etiquette; post slow down signs; Ranger in Forest Park (new position); post allowed uses on the trail

How successful were the physical response(s)?

Marginal

What has been your agency's management response?

Created a new Ranger Position for Forest Park (5000 acre natural area) that can do education and write citations.

Currently developing a volunteer program to educate users about safety and etiquette.

We do not have many enforcement tools because of limited staff and dollars

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

City Code

How well did you find the management response(s) work?

Very limited resources to enforce.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Ensure trails are wide enough for use; separate uses where possible.

F.6.6 City of San Luis Obispo Parks

Agency Contact Information

Name of agency:	City of San Luis Obispo Parks

Agency and Trail System Information

Type(s): single and multi use	City of SLO
Size (acres managed):	Around 4,000
Trail system miles managed:	41 plus
Trail surface types:	Natural and asphalt
Trail user types accommodated:	Foot, bicycle, horse
Additional resources:	Great volunteers

Documenting the Problem

What is the nature of most of the complaints you have received related to user conflicts?
Knock on wood but we don't really have many. Occasionally hiker biker and speed issues but over all they coexist well.

From which group(s) do these complaints usually come?
Hikers

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)
Heavy traffic times like after work or weekends

Where do trail user conflicts most frequently occur?
Areas with little line of sight or area with high speed possibilities

Which combination of trail users is most commonly involved in conflicts with each other?
Hiker vs Biker

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?
Just the one…

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint			X	
Reported Incident			X	
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources		X		
Close calls negatively affect user experience			X	
Congestion or overcrowding on trails			X	

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Typically it is hikers upset about bikers speeds and not seeing them. Bells have really helped ton with this

Responses to Trail User Conflicts

What has been your agency's physical response?

They usually just want to be heard and then they are okay with it. Again the bells have been a nice addition

Never have there been any suggestions for policy changes

How successful were the physical response(s)?

GOOD

What has been your agency's management response?
(i.e., speed limits, citations, exclusion of particular user groups, etc.)

Nothing has been needed….

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

None

How well did you find the management response(s) work?

NA

What other responses did your agency try that did not work?

none

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

We are lucky and id like to keep it that way ☺

In particular, what solution or strategy has the above agency used?

This is just a side note but… I guess the biggest trail user conflicts we have are Dogs off leash people verses everyone else. I get way more calls about that then a user group VS another…

Not sure if that helps at all????

F.6.7 City of Las Vegas

Agency Contact Information

Name of agency:	City of Las Vegas / Public Works / Engineering Planning
Street address:	333 N. Rancho Drive, Las Vegas, NV 89106
Name/position of contact:	Connie Diso
Phone/e-mail:	CDiso@LasVegasNevada.GOV
Responsibility for trail use policy/management:	Planning and funding of the City of Las Vegas Trails Master Plan

Agency and Trail System Information

Trail system miles managed:	Ultimate Master Plan of 239-miles of which approximately 51-miles are constructed to date
Trail user types accommodated:	Shared-use and equestrian trails

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts on soft surface trails?

All of our pedestrian trails are hard surfaced. The equestrian trails are primarily a soft decomposed granite surface.

User conflict complaints are rare on these trails. In fact, only one complaint I've encounteredwas when parents complained of their children walking to and from school had steppedon horse manure on these trails. They claimed that rarely would horses be present, and therefore, the equestrian trails should be turned into sidewalks.

Where do trail user conflicts most frequently occur? (i.e., at a bend on the trail, at a narrow section, etc.)

We have no trail user conflicts on file other than what is stated above.

Does you agency collect or record incidents or complaints?

The types of trail conflicts we have collected are not user conflicts, but are more related to access issues. The trail planning and development challenges the City of Las Vegas faces is due to it being a built-out urban jurisdiction. A challenge with lack of available right-of-way is accomplishing trail connectivity. Until that improves, usage will continue to be minimal and therefore, user conflicts are basically non-existent.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Basically non-existent
Complaint				X
Reported Incident				X
Injury due to collisions				X
Non-injury collision				X
Damage to natural resources				X
Close calls negatively affect user experience				X
Congestion or overcrowding on trails				X
Other (Please Specify)				X

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions? (e.g., weather, design issues, previous interactions/perceptions of user groups, etc.) Please be specific as to the user groups involved.

Not applicable to the City of Las Vegas based on the above answered questions.

Responses to Trail User Conflicts

What has been your agency's response? (i.e., posting/enforcing trail etiquette, designing tight turns to reduce speeds, excluding certain types of users, etc.)

The City of Las Vegas while not faced necessarily with trail user conflicts at this time, does adhere to trail design standards that are based on American Association of State Highway and Transportation Officials (AASHTO) and American Disability Association (ADA) standards.

In addition, trails located near unpaved, open space areas have signage and barriers prohibiting off road vehicles. The comfort and quality of the trails reflect the use of these standards and may be part of the reason conflicts are virtually non-existent.

How successful were the response(s)?

See above.

What design guidelines documents does your agency use?(please provide a link if available online)

http://www.fhwa.dot.gov/environment/rectrails/manuals.htm

http://www.rtcsouthernnevada.com/mpo/streets/

http://www.ada.gov/2010ADAstandards_index.htm

What trail policies or management techniques does your agency use?

The City of Las Vegas does not currently have trail policies or management techniques in place.

If your agency has not experienced many conflicts or complaints, what factors do you believe contribute to removing sources of conflicts?

The City, in general, makes a concerted effort to address citizen complaints in a timely, purposeful and respectful manner. Trail access complaints are noted and being pursued as funding becomes available.

Does your agency have a policy or approach to managing "Other Power Driven Mobility Devices" (OPDMD)'s, based on the new Department of Justice ADA Ruling that power-driven vehicles must be permitted on trails unless a safety assessment is completed (35.137)?

The new DOJ ADA ruling regarding "Other Power Driven Mobility Devices" is being evaluated by our Public Works Department and City Attorney at this time.

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Trail user conflicts are virtually non-existent other than the one listed in question #3A. That particular equestrian/pedestrian conflict was addressed by explaining the intent of the City's Master Plan, and as development progressing and/or funding becomes available safer school routes will be installed. It seemed to placate the complainants.

F.7 Non-Profit Agencies

F.7.1 Forest Park Conservancy

Agency Contact Information

Name of agency:	Forest Park Conservancy
Street address:	1505 NW 23rd Ave, Portland, OR 97210
Name/position of contact:	Matt Wagoner, Trail & Restoration Manager
Phone/e-mail:	matt@forestparkconservancy.org
Responsibility for trail use policy/management:	FPC's field crew is the primary caretaker of the trails in Forest Park. FPC does not make policy but is the "eyes" for Portland Parks and advisor on management decisions in Forest Park.

Agency and Trail System Information

Type(s):	Non-profit
Size (acres managed):	5,100
Trail system miles managed:	80+ miles of trails and fire roads managed as trails
Trail surface types:	Asphalt, aggregate, native soil
Trail user types accommodated:	Hikers, bikers, equestrians
Additional resources:	www.forestparkconservancy.org

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

The FPC field crew works on trails throughout the year and interacts with users on a daily basis. When users identify crew members as a park authority they report conflicts and concerns. Reports also come from the FPC member base which is composed of park users and supporters from the Portland community. Complaints are received by phone, email, and in person. Users typically have concerns about other people not following the regulations of the park. The two most common complaints are that other trail users let their dogs run off leash and that mountain bikers are using pedestrian only trails. It is not common to hear about an actual collision or conflict besides the occasional second hand anecdote.

From which group(s) do these complaints usually come?

Primarily from trail users encountered in the process of maintaining trails and FPC's members/donors. By user group, pedestrian users without dogs usually have the most to say about what other people are doing. Trail users commonly identify themselves as residents of the area as they are filing a complaint. It seems to be a safe assumption that nearby residents are more common users and have a greater sense of ownership in areas of the park.

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

When trail use spikes: weekends and evenings in the summer.

Where do trail user conflicts most frequently occur?

Areas where trail use is most concentrated. The places in the park where it is easily accessed from the city and adjacent neighborhoods.

Which combination of trail users is most commonly involved in conflicts with each other?

Trails users with dogs and trail users without dogs. Mountain bikers and pedestrians is another common conflict.

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Runners and pedestrians, trail users and illegal campers, dogs and other dogs, rogue trail users and non-users

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint	x			
Reported Incident			x	
Injury due to collisions				x
Non-injury collision			x	
Damage to natural resources	x			
Close calls negatively affect user experience	x			
Congestion or overcrowding on trails	x			
Other (Please Specify)				

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

In the conflict between pet owners and non pet owners there are conditions that make the park unique and also cause conflict: Forest Park is a large natural area and also a city park in a dense urban area. The park is used by the many dog owners in Portland who most likely have restricted space for their pet. The opportunity to give their dog unrestricted access to such a large area is likely difficult to resist. Also, the size of the park contributes to limited enforcement capability. There is a single permanent ranger in forest park and more than 80 miles of trails, making the chances of getting a ticket slim and ineffective as a deterrent. Another factor is Forest Park's status as a natural area managed for wildlife as well as recreation. The sensitive nature of the park is fiercely protected by users who place higher priority on the conservation side of management. Some users are also not comfortable around dogs and poorly behaved ones especially can be a source of conflict.

In the case of mountain bikers and pedestrians a lengthy dissertation could be written on the history of user conflicts and the fairly recent public process attempting to resolve some of the issues. To grossly oversimplify: The lack of accessible single track mountain bike trails in the Portland metro area has caused bikers to ride on many of the pedestrian only trails in Forest Park. Many miles of forest road is open to bikes but provide an unsatisfactory experience for many mountain bikers. Pedestrian users commonly confront bikers as they are seen as dangerous in their disregard for the park regulations. The influence of design should not be discounted as trails accessible to both groups intertwine and it may be desirable for bikers to make connections between trails on pedestrian only routes. The existing pedestrian trails have also not been optimized for safety when users of different speeds interact, perhaps causing more close calls and surprises than would occur otherwise.

Responses to Trail User Conflicts

What has been your agency's physical response?

In mitigating dog user conflict, one strategy that is a side effect of restoration efforts has been to make damage impossible, hopefully removing the conflict that results. Particularly sensitive areas have been protected from both human and pet damage by fencing. Riparian areas near high traffic trails have been blocked to both human and pet access. Three foot tall split rail cedar fencing is used for its natural appearance and a section of welded wire fencing is used on the bottom third to prevent dogs from ducking under the bottom fence rail. These sensitive areas are also signed to indicate that dogs should be kept on leash. Signage has been a large part of the physical response. "Dogs and the Environment" interpretive signs and "doggy bag" stations at trailheads have also been implemented. The signs offer some educational details about the impact of dogs on wildlife in natural areas and how to prevent damage.

In some lower traffic areas dogs are discouraged from entering waterways by creating steep drops off of the trail with retaining walls and installing plant material that blocks the line of sight to the stream.

For the mountain bike issue there has yet to be a concerted response to the conflict. Signs have been used for years to indicate which trails do not allow bikes. These signs are constantly vandalized or stolen and it is a continuing effort to develop more permanent markers. Plans are in motion to retrofit existing forest roads for a more enjoyable mountain biking experience and increase the miles of single track for bikers. A trail etiquette education program with signage has been proposed and any new multi-user trail would be designed to limit the speed disparity between bikers and pedestrians while maximizing sight distance and safety. Unfortunately, the conflict has gone beyond the confines of the park so what we can do physically is limited.

How successful were the physical response(s)?

Physical exclusion of dogs has been successful in localized areas by removing the cause for at least one user group's conflict-sparking concerns. Success of interpretive signage is harder to quantify as a comprehensive study of behavior before and after installation was not done. Signs most likely need to be continually updated and improved in conjunction with a focused program of user education and outreach. The existing signs may be too few and the design too wordy to reach many people. Anecdotally, it is apparent that dog owners readily utilize "doggy bags" but it has created another source of conflict when bags are disposed of improperly. More education and improved disposal facilities may be necessary.

What has been your agency's management response?

Along with interpretive signage, education has been a main focus of managing both of these user conflicts. As the primary representatives of FPC in the park and in the public eye, the field crew takes every opportunity to educate dog owners and trail users on trail etiquette and park regulations. Our status as a partner organization prevents us from having any enforcement authority but allows us to interface with the public in a non-threatening manner. Outreach has also been used especially when a group has an established organization. Mountain bikers are a good example of a user group with established clubs that can be engaged in volunteer activities and education. While not a response to the conflict, FPC has had a written agreement to manage the local mountain bike organization's volunteer efforts in the park for years. This type of arrangement can keep communication open and provide opportunities to educate user groups.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

As more of a "soft" response our unofficial policy involves suggestions and guidelines for field crew interactions with the public. When encountering an off-leash dog, the field crew can mention concerns for the safety of the trail workers and pets alike if animals are allowed to wander unrestrained among heavy tool use. It can be as easy as asking politely to leash the dog or notifying the pet owner of city leash laws. If the trail user engages in conversation the crew member can explain the environmental impacts caused by dogs in riparian areas, and as invasive plant seed vectors. Education goes both ways in the conflict, however, and when trail users or volunteers become overzealous in their pursuit of infringers, it can be helpful to explain that well behaved dogs that stay on the trail and obey commands may not pose a threat to anyone regardless of whether they are leashed or not.

When encountered by mountain bikers on pedestrian trails their response is usually to turn around as soon as they identify a crew member. If they are caught unaware then they are notified of the trail's no bike regulation and encouraged to walk their bike to the nearest multi-use trail.

How well did you find the management response(s) work?

When dealing with dog owner conflicts, our efforts have not been very systematic. We respond to the problem when we see it but have not developed a plan to initiate or document change. We are continually working closely with the newly appointed Forest Park ranger, who has the authority to enforce regulations, to build data and develop strategies that address this conflict. With mountain bikers and pedestrians the overall strategy has been to separate them. The debate over the issue was, at times, less than friendly and the big decisions are more or less out of our hands. We continue to maintain communication with the local mountain bike organization and provide our assistance in implementing the physical solutions to the conflict.

What other responses did your agency try that did not work?

Probably the least successful has been the effort to develop a strong volunteer program from the mountain bike community. During the public debate between representatives from many user groups around Forest Park trail usage, attendance to work parties organized for mountain bikers dropped noticeably. It is something that should be pursued again as we move forward with new responses.

Is there anyone else that we should contact who has successfully implemented measures to deal with trail user conflicts?

Agency name:	Portland Parks and Recreation
Agency contact (if available):	Bob Mccoy, Forest Park Ranger
Phone/e-mail:	robert.mccoy@portlandoregon.gov

In particular, what solution or strategy has the above agency used?

Bob McCoy has been working since he was hired several months ago to develop educational programs and gather data on Forest Park infractions.His information is probably in the early stages but could hold some good insight.

F.7.2 Pacific Crest Trails Association

Agency Contact Information

Name of agency:	Pacific Crest Trail Association
Street address:	20130 87th Ave SW, Vashon, WA 98070
Name/position of contact:	Mike Dawson, Trail Operations Director
Phone/e-mail:	206.463.9087/mdawson@pcta.org
Responsibility for trail use policy/management:	I am the lead for these issues for PCTA

Agency and Trail System Information

Type(s):	Non-profit
Size (acres managed):	Trail corridor is well defined in some places, not so much across large agency holdings, hundreds of thousands of acres would be conservative
Trail system miles managed:	2,650 mile long National Scenic Trail running from Mexico to Canada through California, Oregon, and Washington
Trail surface types:	Native surface on 99.9% of trail
Trail user types accommodated:	Hikers, equestrians
Additional resources:	PCTA has 5 regional offices covering 400-700 miles of trail each and a volunteer network of over 1700 trail work volunteers, USFS has full time PCT manager, and one assistant, plus personnel trail wide, also NPS, BLM and CA State Park personnel responsible for sections of PCT

Documenting the Problem

What is the nature of most of the complaints you receive related to user conflicts?

Most conflict results from uses that are not legal on the PCT resulting in trail damage, degraded experiences for intended users, and unsafe conditions for intended users

From which group(s) do these complaints usually come?

Hikers and equestrians

When do trail user conflicts typically occur? (i.e., time of year, time of day, weekend vs. weekday)

Complaints are greater during times of increased use due to increased numbers of encounters: snow free season, weekends, holiday weekends, good weather

Where do trail user conflicts most frequently occur?

Higher use areas mean more complaints, but the seriousness of the complaints increase in wilderness remote back country, etc. because the experiential expectations and investment are greater, so the experiential impact are higher.

Which combination of trail users is most commonly involved in conflicts with each other?

Motorized users and mountain bikers create conflicts with intended users: hikers and equestrians. Safety situation is worse with motorized users (usually dirt bikes) and is worse with equestrian interaction, especially users with a pack string

Which other trail users tend to be in conflict with each other (i.e., less-frequent conflicts)?

Sometimes get contacts from hikers who don't want horses on the trail. Usually urban hikers who don't like horse droppings, or yielding the right of way on narrow trails.

How often do the following consequences of trail user conflicts occur? (Mark with an 'X')

	Weekly	Monthly	Annually	Less than once a year
Complaint	X			
Reported Incident		X		
Injury due to collisions				X
Non-injury collision			X	
Damage to natural resources		X		
Close calls negatively affect user experience	X			
Congestion or overcrowding on trails			X	
Other (Please Specify) Experience degradation	X			

What conditions contribute to conflicts or safety issues between the user groups identified in the previous questions?

Trail is designed for hikers and stock only, by law. Fast, silent approach of mountain bikes on narrow trails with little sight distance. Hikers and equestrians often use the PCT to avoid these illegal uses.

Responses to Trail User Conflicts

What has been your agency's physical response?

Trail is closed to these conflicting uses. Sporadic law enforcement efforts, trailhead signing and other information dispersal.

How successful were the physical response(s)?

Successful with a large percentage of potential illegal users who are law abiding. Not successful with the minority who are not .

What has been your agency's management response?

Exclusion is long standing and in the establishing legislation. Law enforcement usually occurs at particular trouble spots, and in large sting operations.

What trail policy statements, regulations, guidelines, etc. do you have to document the response?

Too Much to list: CFR regulations, Closure orders, planning documents and decisions, comprehensive plan…

How well did you find the management response(s) work?

Not particularly well in various limited locations

What other responses did your agency try that did not work?

Physical barriers

Are there any other success stories or lessons learned with regard to trail user conflicts in your jurisdiction that you would like to share?

Providing high quality alternative opportunities for excluded uses in nearby locations seem to reduce illegal use and conflicts.

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Appendix G. Excerpts – CSP Trail Handbook and Draft Trail Design Guidelines

This appendix provides relevant excerpts from the current CSP *Trail Handbook* and from previously unpublished draft chapters of CSP Trail Design Guidelines that are intended to be incorporated into an updated *Trail Handbook*.

G.1 Excerpts from CSP Trail Handbook (1994)

G.1.1 CSP Trail Classifications

While several individual parks districts have developed regulations and design guidelines, the overarching policies regarding CSP trails are contained in the following:

- The California Recreational Trails Act
- California Recreational Trails Plan - Progress Report (2009)
- California Department of Recreation Trails Policy (No. 2005-06)

The CSP 1994 *Trail Handbook* categorizes trails based on the following factors:

CSP Trail Classifications

- Handicapped accessible
- Interpretive
- Within visitor use facility
- Equestrian and bike
- Adjacent to visitor use facility
- Connection of visitor use facilities
- Parking access
- Destination oriented
- Connection with other agency trail
- Special use or access
- Dead end trail
- Loop or connecting trail
- Fragile environment (protected by lessening use or by upgrading)
- Safety factors
- Staff determined use patterns

Definition of California Department of Parks and Recreation (DPR) Trail Rating Criteria:

1. Trails meeting the Regulatory Negotiation (REGNEG) and DPR accessible trail design and construction guidelines.
2. Trails with a series of interpretive signs or self-guiding pamphlets.
3. Trails that originate and stay within a visitor use facility.
4. Trails used for horse travel or bicycle riding.
5. Trails that start at a visitor use facility or within a radius (mileage listed) of a visitor use facility.
6. Trails that connect two visitor use facilities.
7. Developed or non-developed parking at either end or in the middle of a trail route.
8. Trails with a unique scenic, historical, or recreational feature. (Visitors seek out these trails and point values are given in relation to distance from trail beginning to destination).
9. Any part of a longer regional trail system that connects to another agency trail. (Higher point value assigned to importance and visitor usage of connection).
10. Trails that provide access to memorial or honor groves.
11. "0" points if trail is destination oriented, -3 points if dead end with no sought out destination.
12. Trails that are part of a loop hike or connect to another trail. Higher point value is assigned to the completeness of the loop or importance of the connection.

13. Fragile environment is defined as an area the trail passes through that is sensitive due to wildlife habitat, endangered plant or animal species, geologically unstable, etc. (Negative values are applied to protect by limiting development, positive values for trails needing upgrading to mitigate damage).
14. Safety factors to consider include structures, steep terrain, or precipitous drops. (Positive values are assigned to trails used often and need more maintenance attention. "0" values are assigned for no additional safety concern, higher values for areas needing maintenance to keep trail safe).
15. Staff determination of trail use to offset factors of visitor use patterns not assigned a value.

Mountain bike trails are evaluated on the following criteria:

- Aggressiveness
- Scenic value
- Lake view
- Length
- Parking access
- Part of regional trail
- Special use/access
- Loop or connecting trail
- Dead end trail
- Environmental conditions
- Staff determined use

These criteria result in Class I – IV trails, defined below.

- Class I –. Trail bed: 36″ minimum, 48″ a preferred width.
- Class II –. Trail bed will be a minimum of 24″ wide.
- Class III –. The trail bed will be a minimum of 18″ wide.
- Class IV – special use and access trails

In practice, trail classifications used at individual districts vary. In most districts, a variety of combinations of users are allowed on trails, including pedestrians (walkers, runners, hikers, dog walkers, and pedestrians with mobility impairments), bicyclists (road and mountain), equestrians, and other modes.

Table G-1. California State Parks Trail Classification Guidelines

Class	Uses	Surface Type	Bed Width	Tread Width	Clearing Limits*	Brushing Limits**	Structures
Class I	Interpretive and hiking	Aggregate surfacing	40″ min, 48″ preferred	36″ to 48″	8′ high, 8′ wide	8′ high, 6′ wide	48″ tread, 40″ min tread between handrails and posts
	Accessible equestrian	Aggregate surfacing	40″ min, 48″ preferred	36″ to 48″	10′ high, 8′ wide	10; high, 6′ wide	48″ tread, 52″ min tread between handrails and posts
Class II	Hiking trails providing access into regions away from developed visitor use facilities	Natural surfacing	24″ min	18″ to 24″	8′ high, 8′ wide	8′ high, 6′ wide	48″ tread, 40″ min tread between handrails and posts
Class III	Lightly used hiking trails	Natural surfacing	18″ min	12″ to 18″	8′ high, 6′ wide	8′ high, 4′ wide	Avoid or follow Class I trail guideline
Class IV	Special use and access trails	Natural surfacing	12″ min	10″ to 12″	minimal	minimal	Avoid

** Downed logs and tree limbs.*

*** Woody brush and herbaceous plant species*

G.2 Excerpts from Draft CSP Trail Design Guidelines

G.2.1 Trail Design Standards for Sustainability

Designing or modifying a trail to be sustainable requires a thorough understanding of the landform that the trail is or will be traversing. It also requires an understanding of the user groups the trail is intended to serve and the needs and design standards that are specific to each user group. In addition, the highest quality and most appropriate standards need to be applied to the building and maintenance of trails in order for them to withstand the physical forces of rainfall, runoff, and use. Only by combining this information can the sustainability threshold for each individual trail be determined and achieved.

There are a number of trail design principles that are commonly cited in trail design references to achieve low-impact, low-maintenance, sustainable trails. California State Parks trail design guidelines exemplify these principles.

Sustainable Trail Grade - Trail Grades will be sustainable for the selected use type:

1. With the exception of Accessible trail guidelines, the Department does not have a standard grade requirement for trails. The parent soil capability, combined with user type, frequency of use, hydrological site conditions, degree of vegetation cover, percent of side slope, the relationship of the hill side cross slope to the trail running grade and season of use should all be considered when dictating the percent of trail grade.

2. User comfort should be a consideration for determination of trail grade, but after all the other conditions outlined above are met.

3. If soils and parent material geologic capability are not sustainable, overly steep grades will be mitigated with surface hardening techniques. Hardening techniques (such as high quality compacted aggregate or trail structures such as steps or retaining walls) will keep the surface sustainable, firm and stable.

4. Poorly designed trails and trails traversing low capability geology are often sited in locations where there are no alternate alignments possible for relocation. In these cases the only reconstruction option is to install appropriately designed trail structures. Trail structures are placed to provide comfortable user passage and protection of natural and cultural resources, while providing the best long term maintenance solution.

Maximum Sustainable Grade – Maximum sustainable linear grade is a linear trail grade which, when combined with proper layout and construction, will result in a trail bed that requires only routine maintenance and will not threaten resources, even when subjected to severe weather conditions or heavy use. All trails require some level of maintenance. However, a sustainable trail is expected to perform with only the most basic, routine trail maintenance. In addition, a sustainable trail should not be subject to catastrophic failures during storm events.

Trail user types and the level of use affect the mechanical wear of the trail tread and the trail's sustainability. There are different rates of wear associated with different user groups. The rate of mechanical wear must be considered when identifying the maximum sustainable grade. The amount of use a trail receives also affects the rate of wear; the higher the use, the greater the amount of wear that occurs. This factor must also be considered when determining the maximum sustainable grade.

1. **Outslope** – Trail tread construction should incorporate out-slope design with no berm to impede natural hydrologic sheet flow from crossing the constructed trail surface. Trail tread out-slope should provide for maximum sheet drainage. Unless designated as a Recreational Accessible Trail (California State Parks Accessibility Guidelines, 2009 Ed.), trail tread out-slope will have a minimum cross slope to facilitate sheet drainage.

2. Parent soil capability, combined with user type, hydrological site conditions, degree of vegetation cover, percent of side slope and season of use will dictate the percent of out-slope required to provide sheet flow.

3. Where running grades exceed the trail tread out-slope or trail cross slope, the trail out-slope percentage should be greater than running slope grade.

4. Where there is insufficient difference between the running grade and out-slope, hardening techniques (such as high quality compacted aggregate) will be incorporated to keep the surface sustainable, firm and stable and provide sheet drainage from the trail surface to native undisturbed areas.

Drainage Crossings – All natural topographic drainage features (ephemeral, seasonal or permanent) crossed by the trail should receive some type of drainage dip or swale (hardened or not hardened) to minimize capture and conveyance of natural hydrology onto, or down trail alignments.

G.2.2 CSP Multi-Use Trail Policies and Design Guidelines

- Trails are for access to unique natural, cultural and historic resources protected by State Park Classifications. The trails provide access to enjoy, learn and meditate on the park resources. This is the primary reasons for providing the trail. This type of trail use places the emphasis of the user experience on the "setting" rather than the mode of travel. The use of the trail for a challenging ride and/or exercise is a consumptive use and is not why the trail was established. This type of trail use places the emphasis of the user experience on the mode of travel or locomotion. When the ride or mode of travel across the trail becomes as important, or more important, than the experience of being in the "setting", the trail use is inconsistent with the mission, policies and restrictions of the park classification.

- For a trail to be considered multi-use it must have been designated use for mountain bikers, equestrians and pedestrians. Since trails that are specifically designated for mountain bike and/or equestrian/horse usage also allow pedestrians as a secondary use, these combinations of mountain bike/pedestrian or horse/pedestrian are not considered multi-use.

- When multiple user groups are sharing the same trail, some of the design needs and user expectations of these different user groups cannot be met. Multi-use trail design and construction therefore represents a compromise of the design needs and user expectations for these different groups. This compromise often results in less user satisfaction and greater difficulty in designing and constructing a sustainable trail.

- The most significant conflict arising in multi-use trails is between mountain bikers and equestrians. This conflict is centered on the reaction of horses to the movement of mountain bikers along the trail. The physical and behavioral characteristics of horses make them susceptible to flight when mountain bikers approach them unexpectedly or quickly from the front or rear. The size, shape, sound and speed of the bike and rider can startle a horse. This can lead to the horse rearing up, kicking or bolting. This situation can be partially mitigated by designing multiuse trails to slow the speed of the mountain biker therefore giving the horse more time to recognize the rider and adjust appropriately. Another design technique is make multi-use trails wider, straighter, with longer sight distances and broader turning radiuses. These design characteristics allow trail users to see and hear other users sooner, gives them more time to stop and get off of the trail and gives them more passing room.

- Multi-use trails generally have more trail structures and less sinuosity which can result in a less intimate experience of the surrounding environment.
- When designing multi-use trails the design standards generally default to the highest standards identified for the respective user groups. Generally, equestrian trails have the highest design and construction standards so those would be the minimum standards for any multi-use trails.
- New multi-use trails and trails for consideration of addition of horses and/or mountain bikes should have a similar variety of trail lengths and connecting loops. Trail lengths, connecting loops and circulation patterns pertain whether the entire trail system is designed as a multi-use trail or just the main connecting arteries.
- Multi-use trails should have a minimum tread width that is consistent with equestrian trail standards. In locations where the hillslopes are steep and hikers and mountain bikers may have difficulty stepping off the trail, passing spaces should be provided. Passing areas should be a minimum of 60 inches wide and 60 inches long. The frequency of these passing areas shall be dictated by local site conditions including sight distances, percent of hillslope, and the stability of the parent soils and the general roughness of the terrain.
- The general layout and design of multi-use trails should follow typical design and layout principles. In addition, multi-use trail layout should avoid low gradient hillslopes (< 15%) and flat ground. If flat ground cannot be avoided, the trail tread must be elevated by constructing a turnpike or causeway. On hillslopes, multi-use trails should always be constructed to have a full bench. Since horses and mountain bikes have a tendency to use the outside portion of the trail tread, a full bench will provide more durability and greater sustainability.
- When laying out and constructing multi-use trails, it is important that sudden increases in linear grade are avoided. This will help avoid the additional mechanical tread wear associated with horses, mountain bikes and hikers when they encounter sudden grade pitches.
- Because low trail structures such as steps and waterbars are problematic for horses and mountain bikes they should not be used in multi-use trails. The elimination of steps and waterbars will also reduce the barriers to hikers that may have mobility challenges.
- When designing switchbacks and climbing turns, the design and construction standards should default to equestrians trails which require the highest standards
- When laying out and designing multi-use trails, dry crossings are generally preferred over wet crossings. Culverts, puncheon and bridges on multiple-use trails should be designed to equestrian trail standards. All approaches to drainage crossing structures should be constructed at trail grade.

G.2.3 CSP User-Specific Trail Design Guidelines

G.2.3.1 CSP Mountain Bike Trail Design Guidelines

User Categories

California State Parks trail design guidelines categorize mountain bike users as follows;

Beginning or casual riders

These riders seek easy to moderately challenging trails. They prefer single-track trails that are a little wider, have smooth surfaces, and a gentle meander as they contour around the landform. Typically, these trails are short to moderate in length. These riders enjoy a combination of being outdoors, the beauty of the natural setting, getting exercise, and developing their riding skills. This type of trail is mostly located in front country[1] areas on public lands.

Intermediate riders

These experienced bikers seek moderate to difficult trails. They prefer narrow single-track trails that have tighter turns and rougher surfaces. Typically, the trails are moderate to long in length. These riders enjoy being outdoors, having a more rustic trail experience, maintaining their physical condition, and testing their biking skills. These trails are in front-country and back-country areas on public lands.

Advanced technical riders

These technical trail mountain bikers seek challenging courses with drop-offs, precipitous ledges, logs and rocks to ride (jump) over, elevated bridges, boardwalks, ramps, jumps, and seesaws. They prefer courses designed to challenge even the most experienced mountain biker and their advanced equipment. These riders enjoy being outdoors, testing their riding skills, and the satisfaction of overcoming obstacles. These trails are at ski resorts and mountain biking clubs on public lands. Some federal agencies, such as the Bureau of Land Management (BLM), offer these types of trail courses. The Off Highway Vehicle Division of California State Parks manages lands that may be suitable locations for these trails.

Trail Length and Circulation

The largest numbers of mountain bikers in the US are found in urban areas. They ride their bikes after work and on weekends. To accommodate this user group, trail designers in front-country settings strive to provide trails of varying lengths. Trails of three to ten miles in length provide the distances desired by most mountain bikers for afternoon or evening rides. Longer trail opportunities are provided for riders that have more time and for weekend activities (if the land base is large enough to support this). Back-country trails receive most of their use on weekends, when mountain bikers have time to ride longer distances. Like equestrian trails, interconnected loop trails that progressively get longer will provide options to mountain bikers for their various riding needs.

[1] "Front-country" refers to park areas that are within or close to urban areas. "Back-country" refers to park areas that are relatively remote.

Tread Width

Front-country single-track trails have a minimum tread width of 30 inches. Although the primary user is the mountain biker, hikers are frequently encountered. In locations where the hillslopes are steep and hikers have difficulty stepping off the trail, passing spaces should be provided. Passing spaces are a minimum of 48 inches wide and 60 inches long. On back-country trails with a minimum tread width of 18 inches, passing areas are a minimum of 36 inches wide and 60 inches long.

Trail Layout and Tread Construction

The general layout, design, and construction of mountain bike trails will follow the standard principles. In addition, an important element in mountain bike trail design is reducing biker speed. High rates of speed lead to increased user conflicts (even with other mountain bikers), safety issues, resource degradation, and trail sustainability issues. One method of speed reduction is to avoid laying out trail segments that have long, straight, and uninterrupted sight lines. If the biker can see a clear route ahead (particularly on downhill runs) that has no turns or natural features to maneuver around, they will accelerate through that segment. When they come to the end of that segment and encounter a curve in the trail, a natural feature to maneuver around, or another trail user, they will apply their brakes hard. This braking action causes the bike to go into a skid. The tires dig into the soil across the trail tread and push the soil toward the outside edge. When this action is repeated over a period of time, an entrenched trail tread develops, with a berm on the outside edge. The trail can no longer effectively sheet overland runoff and becomes a ditch that collects and diverts water, making the trail a liability to the resources and unsustainable. This type of use also increases the potential for user conflicts and accidents.

By following a curvilinear alignment, the trail can achieve a fair amount of turns by contouring around the landform, avoiding trees and rock outcroppings, and dipping in and out of drainage crossings (including micro-drainages such as swales and crenulations). With mountain bike trails, additional turns are necessary to reduce user speed. This is achieved by using natural features such as trees, brush, rocks, and down logs that the trail must go over or under. However, the trail designer must be careful not to create trail grades exceeding the maximum sustainable grade or create sudden pitches that cause the mountain biker to brake hard going downhill or stand on their pedals when going uphill. Keeping linear grades below the maximum sustainable grade and selecting natural objects to weave over or under without rapid elevation change is critical to successful mountain bike trail design. The frequency of natural features encountered on this type of trail can be adjusted to provide higher or lower levels of challenge to the biker. These variables, along with adjusting the tread width, allow the designer to create a sustainable trail alignment tailored to beginning or casual riders and intermediate riders.

If the landform lacks natural features, rocks and logs can be placed adjacent to the trail as artificial choke or pinch points. These objects can be placed above and below the trail bench where the trail curves or turns. The objects are offset, with one being further up or down the trail from the other, and placed outside of the designed width of the trail tread. When placed in this way, these objects will appear to the rider as adjacent with only a narrow opening between them. The mountain biker will slow down to negotiate between the two objects. Since the opening is wider than the designed tread width, the location does not present an increased safety risk to the user.

A weaving or sinuous trail design makes the mountain biker slow down. This eliminates the need for hard braking, and the trail tread receives less wear, the impact on resources is reduced, sustainability is achieved, and user conflicts are avoided. This type of alignment also produces a more challenging ride for the mountain biker and increases user satisfaction, and helps curb illegal trail riding and unauthorized trail construction that are prevalent on State Park and other public lands.

Mountain bike trail layout also should avoid low gradient hillslopes (less than 15 percent) and flat ground. If flat ground cannot be avoided, elevate the trail tread by constructing a turnpike or causeway. On hillslopes, mountain bike trails should always have a full bench for more durability and greater sustainability. Mountain bikers have a tendency to ride in the same track regardless of the trail's location on the hillslope. A "grooving" of the trail usually occurs on the outer third of the trail tread. If this portion is comprised of fill material, the trail bench rapidly breaks down.

Trail tread needs to be uniformly firm and smooth to allow overland sheet flow. However, on back-country mountain bike trails where native rock is encountered during construction, a portion of that rock can be retained within the tread (textured or roughened surfaces) if it does not impede overland sheet flow or present a tripping hazard. Leaving rock projecting into the trail tread further reduces the speed of mountain bikers and provides a more challenging ride.

If parent or native soils are not suitable for long-term sustainability, trail tread can be strengthened by adding crushed rock aggregate.

Low Trail Structures

Low trail structures, such as steps and waterbars, should be avoided on mountain bike trails. Mountain bikers have a difficult time negotiating these structures, especially riding uphill, and often ride around them, which can damage the trail and cause resource impacts. Steps, when encountered by bikers, make them dismount and walk up or down, or ride around (on the downhill side of the steps). This leads to erosion of the fillslope and undermines the step structure, leading to resource degradation and trail maintenance/sustainability problems. When designing and laying out new mountain bike trails, steps are never used. If existing mountain bike trails have steps, the trail should be reconstructed or rerouted to eliminate them. If this is not possible, they should be constructed to appropriate step design as prescribed in the CSP revised Trails Handbook.

Switchbacks and Climbing Turns

When designing switchbacks and climbing turns, the radius must be wide enough for mountain bikers to negotiate. A turning radius that is too tight will cause bikers to cut across the inside corner when going downhill. At the turn, the grade between the upper and lower legs is steeper, and mountain bikers can erode the trail tread. Bikers riding uphill dismount if they cannot sustain enough momentum to make it around the tight turn. A minimum turning diameter of eight feet is required for switchbacks (six feet for climbing turns) on bike trails. The grade of the upper and lower leg of the turn should not exceed 14 percent, unless the material is durable enough to support a steeper grade. Grades should not exceed 20 percent, due to the difficulty of climbing such a steep turn on a bike.

Drainage Crossings

Wet crossings should not be considered for mountain bike trails unless flows are shallow and have low velocities. All wet crossings, even those across swales, should be armored to protect soils and stream gravels, reduce erosion and sediment delivery, and be sustainable.

Dry crossing designs are preferable for mountain bike trails. Culverts, puncheon, and bridges on mountain bike trails should be designed to pedestrian trail standards. All approaches to drainage crossings should be constructed at trail grade.

G.2.3.2 CSP Equestrian Trail Design Guidelines

Trail Length and Circulation

Although many equestrians ride their horses for long distances in remote back-country settings, most are not trained or in condition for this type of riding. The largest population of equestrians in the United States is in urban areas. Trail design principles in front-country settings should provide trails of varying lengths, typically three to eight miles in length.

Loop trails are preferable for all user groups. Retracing a path is not as stimulating as traversing over new ground. With equestrians, loop trails are important because a horse can become "barn sour" when retracing a path. When a horse knows they are heading back to camp or a trailhead, they sometimes get anxious. Knowing that food, water, the company of other horses, and the relief of not carrying their rider is close at hand can cause them to pick up their pace and become difficult to handle. This behavior is reduced when riding loop trails.

Water

Horses require between 12 and 20 gallons of water per day, depending on the weather, amount of exercise, physical size, and food consumed. Trail distances greater than seven miles require watering stations. Water troughs should be properly located and of appropriate design for longer trails. Horses should not be allowed to drink from streams, ponds, and springs due to the impact associated with their ingress and egress, or from urinating and defecating in sensitive areas.

Tread Width

Front-country equestrian trails should have a minimum tread width of 48 inches; back-country trails should have a minimum tread width of 36 inches. Although the primary users are equestrians, hikers will be encountered frequently on these trails. When the hillslopes are steep and hikers will have difficulty stepping off the trail, passing spaces should be a minimum of 60 inches wide and 60 inches long.

Trail Layout and Tread Construction

Equestrian trail layout should avoid low gradient hillslopes (less than 15 percent) and flat ground. When flat ground cannot be avoided, elevate the trail tread by constructing a turnpike or causeway. On hillslopes, equestrian trails always have a full bench for durability and greater sustainability. Horses tend to walk on the outside edge on trails that are constructed on hillslopes. This may be related to their limited binocular vision and prey instincts. Staying on the outside edge of the trail provides them with a better view of the uphill side of the trail, where potential predators would likely approach. Their tendency to walk on this portion of the trail makes full bench construction imperative.

If native soils are not suitable for long-term sustainability, trail tread can be strengthened by adding crushed rock aggregate. Hardened and smooth trail surfaces such concrete, soil cement, asphalt, and non-permeable soil stabilizers should not be applied to trails designated for equestrian uses. These surfaces are slippery and cause horses to loose their traction and fall. They also can injure the bottom of the hoof.

Grade Uniformity

Sudden increases in linear grade are to be avoided when laying out and constructing equestrian trails. When linear trail grades are relatively constant, horses have a steady gait. When those grades suddenly increase (such as going from a five percent to a ten percent grade in ten linear feet), horses will adjust their stride to compensate. Horses will push off harder with their back legs when going uphill. This transfers more weight to the hind legs and applies more force to the hooves. When going downhill, the horse will sit back on its rear legs and break its descent with its hooves. This also transfers more weight to the hind legs and applies more force to the hooves. These actions result in the hooves penetrating deeper into the trail tread and displacing more soil. Over a period of time, these sections of trail can become entrenched and develop drainage problems.

Trail Structures

Due to the blind spot directly in front of the horse's feet, low trail structures such as steps and waterbars should be avoided on equestrian trails. Horses have a difficult time recognizing these structures and will trip over them or walk around them. Waterbars are generally not an effective drainage solution and should be avoided. Steps on horse trails are also problematic. When designing and laying out new equestrian trails, steps should never be utilized. If existing trails have steps, the trail should be re-routed to eliminate them. If elimination is impossible, steps should be constructed according to DPR equestrian specifications.

Switchbacks and Climbing Turns

The radius of the turn must be wide enough to accommodate horses. If the turning radius is too narrow, horses will cut across the inside corner of the turn. At the turn, the grade between the upper and lower legs is steeper. Horses will erode the trail tread as described above. A minimum turning diameter of 10 feet is required for equestrian trails. If the trail is used by pack stock, the diameter should increase to 12 feet. The grade of the upper and lower leg of the turn should not exceed 14 percent, unless the parent material is durable enough to support a steeper grade.

Drainage Crossings

For equestrian trails, wet crossings or fords are preferred over bridges. All wet crossings, even those across permanent streams need to be armored to protect soils and stream gravels.

Some horses become nervous walking across a bridge. This is related to their depth perception, sensitivity to vibrations through their hooves, and reduced traction on unnatural surfaces. Horses are also more confined while crossing bridges and their options for flight are severely limited. However, crossing limitations and environmental concerns will often necessitate a bridge. Bridges on equestrian trails should be designed to accommodate the size, weight, and traction needs of horses. The bridge should be wide enough and/or the handrails high enough that the horse and equestrian feel unconfined, but also protected at the edge of the bridge.

Appendix D

Trail User
Responsibility and Conflict Resolution
Policy Notice No. 2005-06

State of California - The Resources Agency DEPARTMENT OF PARKS AND RECREATION **POLICY NOTICE**	**No. 2005-06**	MANUAL Operations
SUBJECT TRAILS POLICY		CHAPTER 1800, Park Operations (Old DOM 1400 chapter)
ISSUED 8/3/2005	EXPIRES When Incorporated	REFERENCE Supersedes DN 88-65

DPR 375 (Rev. 10/2001)(Word 6/25/2002)

This Departmental Notice has been re-created for transmittal in electronic format. The original notice was signed by Theodore Jackson, Jr., Deputy Director – Park Operations.

The following procedure supersedes those issued in Departmental Notice 88-65. This revision sets the Department's procedure for establishing and approving trails and their appropriate uses and clarifies the management roles and responsibilities of the various levels of the Department.

Preface

California State Parks' mission statement and the California Park and Recreation Commission *Statement of Policy (2.Opportunities)* direct the Department to provide opportunities for high-quality outdoor recreation. Trails are a primary state park facility that offer health-enhancing recreational opportunities, access to park resources for interpretation and education, and enhance community involvement.

Policy

It is the policy of California State Parks to provide trails for accessing park features and facilities and to provide planning that will effectively meet near-term and long-term recreation opportunities. The Department, through a public planning process, will strive to meet the recreational, educational and interpretation needs of its diverse trail users by developing trails within state park units, consistent with unit classification, general plan directives, cultural and natural resource protection, public safety, accessibility, user compatibility and other legal and policy mandates. Multi-use trails and trail connectivity with adjacent public trail systems will be considered in the development of trail plans or individual trails. Further, District Superintendents have the responsibility for implementing emergency, temporary trail closures, through a posted Superintendent's Order, for such reasons as resource protection and public safety. All trail plans, trail development and trail related management decisions will be consistent with the California Environmental Quality Act (CEQA).

Guidelines

The Department's *Trails Handbook* serves as the Department's guideline for trail design, construction, survey, operations and maintenance standards. Trail planning is necessary to effectively balance public access and recreational needs or desires with management requirements to ensure appropriate levels of resource protection and public safety. The *Handbook* provides a detailed Unit Trails Plan template and guidelines that will ensure adequate trail system planning and public input.

Delineation of Responsibilities
Staff responsibilities in implementation of this policy include:

- **District/Sector/Park Units**
  Identify a District Trails Coordinator and provide appropriate trails related training and program development opportunities.

  Complete a comprehensive Unit Trail System Plan for each park unit when feasible and appropriate.

  District Superintendents will be responsible for addressing trails issues that are brought to their attention by staff or by the public within the District in a timely manner.

- **Field Division Chiefs**
  Provide statewide consistency reviews for Unit Trail System Plans and for specific District trail project decisions, such as changes in use, where potential statewide implications may exist. Work with the Statewide Trails Manager in his/her ombudsman role in resolving trail related issues with the public.

- **Deputy Director, Park Operations**
  Responsible for the final resolution of trail related issues brought forward by the Field Division Chiefs and the Statewide Trails Manager in his/her ombudsman role.

- **Accessibility Office**
  Provide review of all trail projects to ensure adherence to Accessibility guidelines, goals and objectives.

- **Statewide Trails Office**
  Provide assistance for the planning and development of Unit Trail System Plans and review plans prior to final approval.

  Assist in planning and coordinating of the Department efforts in trails training and in trail design and construction projects as requested.

  Provide support for grant application preparation for trails-related grant funding sources and acts as the RTP and EEM grants project officer for approved state park projects.

  Assist the Districts in resolving user conflicts and conflicts between the needs of natural and cultural resource protection, public safety and the recreation needs of the public.

The Statewide Trails Manager will serve as a “third party” ombudsman, working with Field Operations and Headquarters’ management in addressing California State Parks’ public trail issues not resolved at the District level.

- **Department Training Center**
  Provide an ongoing Trails Training Program emphasizing the latest techniques, tools and materials for the design, construction and maintenance of trails.

Conflict Resolution Procedure:

The following standard operating procedure will apply to minimize and resolve public concerns and conflicts regarding trail use in a District. These conflicts may arise from an action such as a new or revised trail plan, park unit general plan or other District policy that affects trail use.

The procedure will create an opportunity for meaningful public input. This procedure could include one or more of the following: creation of an ad-hoc committee that will sunset when the issue is resolved, facilitating public meeting(s), sponsoring user forums, replying to letters, or any other activity that allows the public an opportunity for providing suggestions and/or relaying concerns.

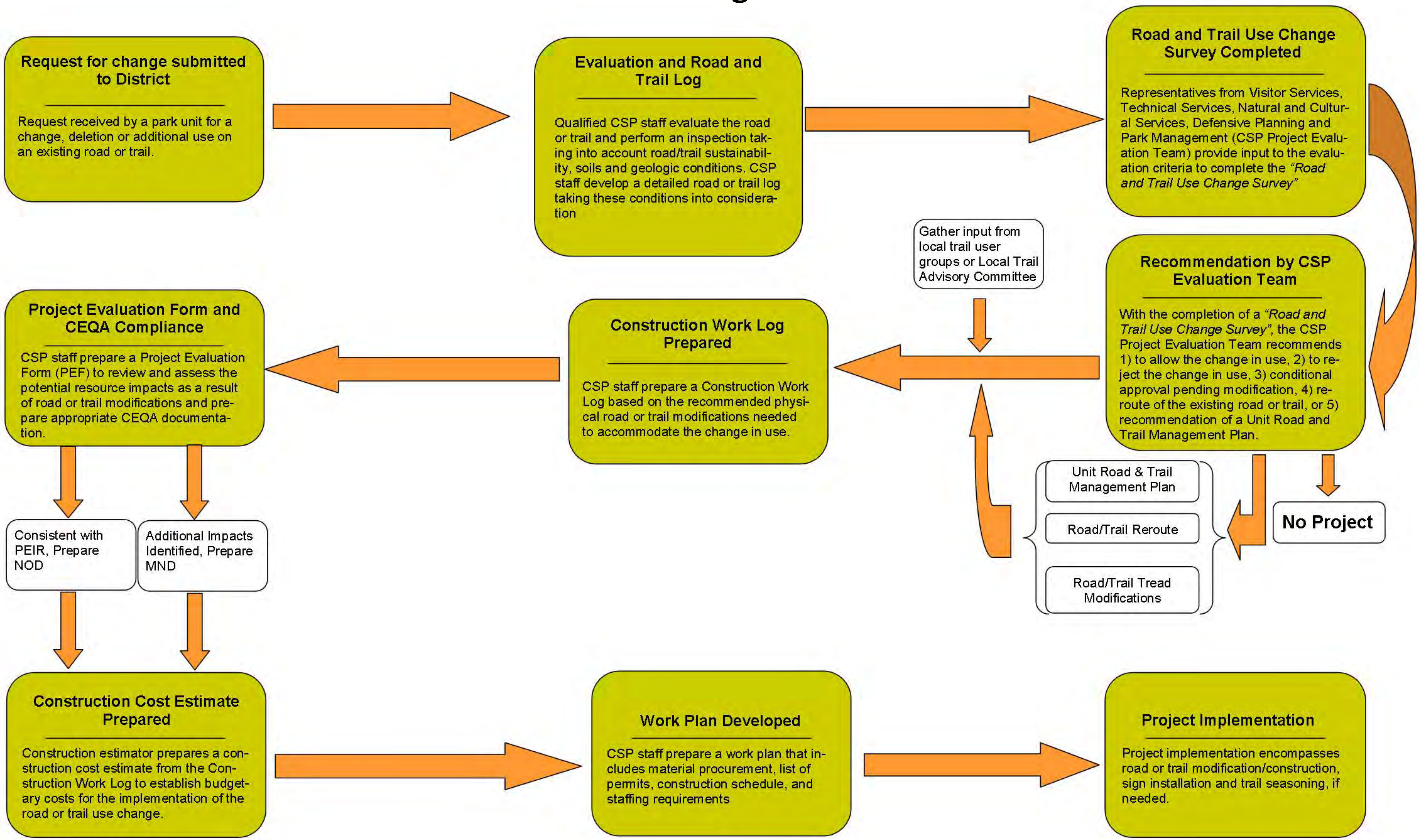
1. Each District Superintendent shall establish a procedure under the guidelines above that best responds to accepting public input/comment on the issue.
2. If an agreement can not be reached, the issue(s) will be brought to the Statewide Trails Office (STO) as a mediating/ombudsman role. The STO will obtain input from all parties affected and attempt to reach a resolution. If agreement cannot be reached, the STO will provide an assessment and recommendations to the Deputy Director of Park Operations.
3. The Deputy Director of Parks Operations will review the information and make a final recommendation to the Director and Chief Deputy Director of State Parks through a Directors Action Request form. The recommendation will include the background on the previous negotiations.
4. Depending on the magnitude of the issue, The Director also has the discretion to determine the method of public input at each step in the process.

Theodore Jackson, Jr.
Deputy Director
Park Operations

Appendix E

Trail Use Change Survey and Project Evaluation Form

Trail Use Change Process



X10010034 03 003

Trail Use Change Survey

Version 1-July 2008

Park (Including Classification): ______________________

Trail Name: ______________________

Location in Unit: ______________________

Current Use Designation(s): ______________________

Proposed Use Type Change: ______________________

Use Change Initiated By: ______________________

Evaluation Date: ______________________

Evaluation Criteria

	Yes	No
Based on Criteria, is this Use Change Compatible?		
Based on Criteria, does this Use Change Enhance Circulation?		
Based on Criteria, will this Use Change Decrease Trail Safety?		
Based on Criteria, is the Trail Sustainable Under Existing Use Conditions?		
With the Proposed Use Change Will the Trail be Sustainable		
Based on Criteria, will the Proposed Used Change Create Negative Impacts to the Natural or Cultural Resources?		
Will the Proposed Use Change and/or Modifications to the Existing Trail Create Significant Facility Maintenance or Operational Work Load?		
Are there other Routes in the Unit or on Nearby Public Lands that Adequately Accommodate the Type of Trail Use Proposed?		
Would needed modifications trigger outside agency permits?		

Recommendation Based on Evaluation Criteria - Substantiate in Comment Box

Recommend that the Park's General Plan or Road and Trail Management Plan be Developed or Amended to Evaluate this Change in Use		
Recommend that the Proposed Change in Trail Use be Approved		
Recommend that the Proposed Change in Trail Use be Approved After Design Modifications are Implemented:		
Recommend that the Major Reroute be Considered to Accommodate Proposed Change in Use		
Recommend that the Proposed Change in Trail Use be Approved with Management Options such as: Alternating Days of Use, One Way Travel, Seasonal Closures etc.		
Recommend that the Proposed Change Use be Put on Hold - See Comment Box Below		

Summary Criteria Evaluation Based on the Synthesis of Data from the Following Pages

Insert Map of Area of Proposed Use Change

Trail Use Change Survey

Version 1-July 2008

Comments:

Evaluation Team Members: ______________________ ______________________

______________________ ______________________

Multiple trail route use change proposals in one unit may recommend development or amendment of a unit wide road and trail transportation management plan.

Qualified Department District Staff, including a DPR Trained Trail Coordinator will complete this survey and checklist to:

(1) Determine the sustainability, trail user safety and feasibility of a proposed change in allowed uses for a single existing trail.

(2) Determine the appropriateness of proposed use change in relation to cumulative impacts to the existing uses (users, routing, hiking opportunities, etc)

(3) Support and Document the Request with a Project Evaluation Form and associated CEQA document.

(4) Validate the existing conditions described on the attached trail log. The trail log should address typical log elements and positive and negative attributes related to the evaluation criteria.

	Evaluation Criteria	Yes	No	Comments
	#1 Existing Conditions			Describe positive and negative impacts of the proposed change and any other details related to the question to assist decision is made . Put N/A in "No" section for criteria not applicable to trail evaluated.
	Check any existing conditions:			
1.1	Does the Park Unit have a General Plan?			
1.2	If Yes, does it address specific trail uses or other management directive supporting the proposed use change			
1.3	Is the "Trail" Proposed a Controlled Access Road			
1.4	Does the Park have an approved road and trail management plan?			
	Trail or Road Surface Type:	**Check Applicable**		
1.5	Asphalt			
1.6	Concrete			
1.7	Gravel			
1.8	Native Material			
	Trail and Road Facility Use Type			
1.9	Public			

Trail Use Change Survey

Version 1-July 2008

	Evaluation Criteria	Yes	No	Comments
1.10	Administration			
1.11	Fire Break			
1.12	Motorized Recreation			
1.13	Non-Motorized Recreation			
1.14	ADA Accessible Route of Travel			
1.15	Does the proposed route connect to a Trail Head or other Accessible Facility?			
1.16	Road Used as Trail Route			
	Trail Specific Facility Use Type			
1.17	Trail Class I, II, III, IV			Enter Trail Classification Here - Not Yes or No
	Current Trail Uses Allowed (on road or trail)	**Yes**	**No**	
1.18	Pedestrian			
1.19	Mountain Bike			
1.20	Equestrian			
1.21	Other - Specify in Comment Box			
	#2 Compatibility for Multi-User Trails			
	Check any existing conditions:			
2.1	Would the proposed use change create incompatible conflict with existing facilities (trail heads, stables, campgrounds etc)?			
2.2	Is it located on a trail already in a high use area and are there resource impacts?			
2.3	Is there significant user conflict?			
2.4	Is there evidence of unauthorized use?			
2.5	Is it consistent with park classification?			
2.6	Does the Proposed Use Currently Exist in the Park?			
2.7	Is there documented survey or statistical information that identifies a need for proposed additional use designation?			
2.8	Is the existing trail considered ADA accessible by US Access Board?			
2.9	Based on Above Criteria, Is this Use Change Compatible?			
	#3 Affects to Trail Unit User Circulation Patterns			
	Check any existing conditions:			
3.1	Does the proposed use change provide a loop or semi loop connection?			
3.2	Does the change provide a legal or legitimate route for existing unauthorized trail uses or user created trail?			

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
3.3	Does the change provide a connection to adjacent land agency which allows similar use?			
3.4	Does it improve circulation or relieve congestion on other high use or at capacity trails?			
3.5	Does it create potential additional use changes on surrounding/adjacent or connecting trails or facilities?			
3.6	Does it require a seasonal closure to mitigate resource impacts?			
3.7	If yes, will seasonal closures disrupt circulation patterns?			
3.8	Based on Above Criteria, Does this Use Change Enhance Circulation			
	#4 Effects to Trail Use Safety			
	Check any existing conditions:			
4.1	With standard cyclic trail brushing (as required by the trail Class), is there adequate site distance for safe warning for the proposed use change?			
4.2	With standard cyclic slough and berm removal, is there adequate tread width for safe passage for the proposed multi-user designation?			
4.3	With equestrian mutli-use, are tread widths safe for the pedestrian, mobility devices and/or bike user to retreat to the downhill side of trail?			
4.4	If tread widths for equestrian use is narrow, are the fill slopes gentle, firm and stable for the pedestrian, mobility devices and/or bike user to retreat to the downhill side of trail?			
4.5	Does the trail have sinuosity that slows bike users?			
4.6	Can sinuosity be designed into existing trail tread alignment to slow bike users?			
4.7	Does the use change require removal of special concern plant species to maintain adequate trail widths and sight distances?			
4.8	Would use type change existing conditions or cause problems for enforcement of park rules and regulations?			
4.9	Would use type change existing conditions or cause problems for emergency response?			
4.10	Would alternating days of use reduce the change of use impacts to reduce safety concerns?			

Evaluation Criteria		Yes	No	Comments
4.11 Based on Above Criteria, Will this Use Change Decrease Trail Safety?				
#5 Effects on Trail Sustainability				
Check any existing conditions:				
5.1 Are trail grades commensurate with soil types, use type, season use and facilitate natural hydrologic drainage patterns such as sheet flow?				
5.2 Is the trail drainage being captured and released on hillsides and not at natural topographic drainage features?				
5.3 Trail tread firm and stable?				
5.4 Are there abrupt changes in trail running grade?				
5.5 Is the fill slope stable?				
5.6 Is the back slope/cut bank stable?				
5.7 Does the trail tread remain firm and stable in wet conditions?				
Supporting Data From Trail Log				
5.8 Number of Water Bars required for proper drainage				
5.9 Lineal Footage of Berms				
5.10 Lineal Footage of Ditches				
5.11 Lineal Footage Rills and Ruts				
5.12 Lineal Footage log Entrenched Trail				
Describe the locations and different types of soil types and matrix encountered on trail	% of			
5.13 Rocky				
5.14 Rocky/Partial Soil Profile				
5.15 Full Soil Profile				
5.16 Partial Soil Profile/Sandy				
5.17 Sandy				
5.18 Based of Above Criteria, is the Trail Sustainable Under Existing Use Conditions?				
5.19 With the Proposed Use Change, will the Trail be Sustainable?				
If Not Sustainable, Can Any of the Following Measures be Implemented to Make the Trail Sustainable for the Proposed Use Change?				

Trail Use Change Survey

	Evaluation Criteria	Yes	No	Comments
	Minor reconstruction of trail tread would:			
5.20	Correct lack of outslope			
5.21	Eliminate abrupt grade changes			
5.22	Stabilize unstable cut bank			
5.23	Stabilize unstable fill slope			
5.24	Correct rilling, rutting			
	Provide for firm and stable surfaces			
5.25	Minor realignment of trail within immediate existing trail proximity would:			
5.26	Stabilize unstable cut bank			
5.27	Stabilize unstable fill slope			
5.28	Eliminate abrupt grade changes			
5.29	Correct unsustainable grades			
5.30	Correct Lack of sinuosity			
5.31	Based on Above Criteria, Can the Trail be Made Sustainable for Proposed Use Conditions?			
5.32	Can wet weather closures establish or maintain Sustainability?			
5.33	Should a Major Reroute be Considered to Establish Sustainability?			
	#6 Effects or Impacts to the Natural or Cultural Resources			
	Would proposed use change and/or needed modifications significantly impact:			
6.1	erosion of existing Trail Tread?			
6.2	geologic conditions?			
6.3	sensitive wildlife habitat?			
6.4	sensitive vegetation habitat?			
6.5	a riparian or stream environment zone			
6.6	a sensitive historic feature?			
6.7	Is the Trail a historic feature?			
6.8	Based of Above Criteria, Would the Proposed Used Change Create Negative Impacts to the Natural or Cultural Resources?			
	#7 Effects or Impacts to the Facility Maintenance and Operational Costs			
	Would proposed use change and/or needed modifications:			

Trail Use Change Survey

Version 1-July 2008

Evaluation Criteria		Yes	No	Comments
7.1	Change the current classification of the trail?			
7.2	Create the need for fill slope or cut bank retaining walls?			
7.3	Require aggregate or other trail hardening techniques required to maintain tread stability?			
7.4	Require additional or upgrading of turnpikes or causeways?			
7.5	require additional bridges or puncheons?			
7.6	Require additional maintenance to maintain current existing conditions?			
7.7	Require additional management practices to maintain user compliance?			
7.8	Could the proposed modifications be completed by non-department work forces?			
7.9	Could the proposed modifications be maintained by non-department work forces with no cost to State Parks?			
7.10	Are durable pinch point native materials readily available?			
7.11	If alternating days of use by user type is a management practice, is alternating days of use able to be enforced?			
7.12	Will the Proposed Use Change and/or Modifications to the Existing Trail Create Significant Facility Maintenance or Operational Work Loads?			

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION

Project ID No. _______________

PROJECT EVALUATION (PEF)

PCA No. _______________

PROJECT CONCEPT

PROJECT TITLE		PARK UNIT NAME
DISTRICT NAME		FACILITY NO.
PROJECT MANAGER	PHONE NO.	EMAIL
DISTRICT PROJECT MANAGER	PHONE NO.	EMAIL
PROJECT BID DATE	CONSTRUCTION START DATE	FUNDING SOURCE

PROJECT DESCRIPTION

Identify the scope of the project in detail, including its purpose, location, and potential impacts. If the ground is to be disturbed, describe the depth and extent of excavation. Describe the existing site conditions, including previous development. Note if work will impact or extend beyond park property. Indicate if work will be done in conjunction with, or as part of, other projects. (Use additional pages if necessary.)

DOCUMENTS ATTACHED

- ☐ 7.5 minute (quad) map of project area *(**Required**)*
- ☐ Site Map *(**Required** - Scale should show relationship to existing buildings, roads, landscape features, etc.)*
- ☐ Graphics (*Specify - photos, diagrams, drawings, cross-sections, etc.)*:
- ☐ Other (*Specify)*:

REGULATORY REQUIREMENTS

IS AN APPLICATION, PERMIT, OR CONSULTATION REQUIRED?	YES	MAYBE	NO	CONTACT
Coastal Development Permit	☐	☐	☐	☐
DFG Stream Alteration Permit	☐	☐	☐	☐
State & Federal Endangered Species Consultation	☐	☐	☐	☐
Corps of Engineers 404 Permit	☐	☐	☐	☐
RWQCB or NPDES Permit	☐	☐	☐	☐
DPR Right to Enter or Temporary Use Permit	☐	☐	☐	☐
PRC 5024 Review	☐	☐	☐	☐
Americans with Disabilities Act	☐	☐	☐	☐
Stormwater Management Plan	☐	☐	☐	☐
Encroachment Permit *(Specify Agency)*:	☐	☐	☐	☐
Other (*Specify)*:	☐	☐	☐	☐

COMMENTS:

Project ID No. ______________

PROJECT EVALUATION (PEF)

PCA No. ______________

DEPARTMENT POLICY COMPLIANCE

	YES	NO
HAS A GENERAL PLAN BEEN APPROVED FOR THE UNIT?	☐	☐
If YES, is the project consistent with the GP?	☐	☐
If NO, what is the project justification?		
Is it a temporary facility? (No permanent resource commitment)	☐	☐
Health and Safety?	☐	☐
Is it a Resource Management Project?	☐	☐
Is it repairing, replacing, or rehabilitating an existing facility?	☐	☐
IS THE PROJECT WITHIN A CLASSIFIED SUBUNIT?		
Natural Preserve	☐	☐
Cultural Preserve	☐	☐
State Wilderness	☐	☐
IS THE PROJECT CONSISTENT WITH THE DEPARTMENT'S CULTURAL RESOURCE MANAGEMENT DIRECTIVES?	☐	☐
IS THE PROJECT CONSISTENT WITH THE DEPARTMENT'S OPERATIONS MANUAL CHAPTER 0300?	☐	☐

COMMENTS:

SUPERINTENDENT PROJECT CONCEPT APPROVAL OR DESIGNEE	TITLE	DATE

RESOURCES

Explain all 'Yes' or 'Maybe' answers in the "Evaluation and Comments" section (reference by letter and number). Attach additional pages, if necessary.

YES	MAYBE	NO	**A. EARTH** – *WILL THE PROJECT:*
☐	☐	☐	1. Create unstable soil or geologic conditions?
☐	☐	☐	2. Adversely affect topographic features?
☐	☐	☐	3. Adversely affect any unusual or significant geologic features?
☐	☐	☐	4. Increase wind or water erosion?
☐	☐	☐	5. Adversely affect sand deposition or erosion of a sand beach?
☐	☐	☐	6. Expose people, property, or facilities to geologic hazards or hazardous waste?
☐	☐	☐	7. Adversely affect any paleontological resource?

YES	MAYBE	NO	**B. AIR** – *WILL THE PROJECT:*
☐	☐	☐	1. Adversely affect general air quality or climatic patterns?
☐	☐	☐	2. Introduce airborne pollutants that may affect plant or animal vigor or viability?
☐	☐	☐	3. Increase levels of dust or smoke?
☐	☐	☐	4. Adversely affect visibility?

YES	MAYBE	NO	**C. WATER** – *WILL THE PROJECT:*
☐	☐	☐	1. Change or adversely affect movement in marine or fresh waters?
☐	☐	☐	2. Change or adversely affect drainage patterns or sediment transportation rates?
☐	☐	☐	3. Adversely affect the quantity or quality of groundwater?
☐	☐	☐	4. Adversely affect the quantity or quality of surface waters?
☐	☐	☐	5. Expose people or property to flood waters?
☐	☐	☐	6. Adversely affect existing or potential aquatic habitat(s)?

Project ID No. ______________

PROJECT EVALUATION (PEF)

PCA No. ______________

YES	MAYBE	NO	**D. PLANT LIFE** – *WILL THE PROJECT:*
☐	☐	☐	1. Adversely affect any native plant community?
☐	☐	☐	2. Adversely affect any unique, rare, endangered, or protected plant species?
☐	☐	☐	3. Introduce a new species of plant to the area?
☐	☐	☐	4. Adversely affect agricultural production?
☐	☐	☐	5. Adversely affect the vigor or structure of any tree?
☐	☐	☐	6. Encourage the growth or spread of alien (non-native) species?
☐	☐	☐	7. Interfere with established fire management plans or practices?

YES	MAYBE	NO	**E. ANIMAL LIFE** – *WILL THE PROJECT:*
☐	☐	☐	1. Adversely affect any native or naturalized animal population?
☐	☐	☐	2. Adversely affect any unusual, rare, endangered, or protected species?
☐	☐	☐	3. Adversely affect any animal habitat?
☐	☐	☐	4. Introduce or encourage the proliferation of any non-native species?

YES	MAYBE	NO	**F. CULTURAL RESOURCES** – *WILL THE PROJECT:*
☐	☐	☐	1. Adversely affect a prehistoric or historic archeological site?
☐	☐	☐	2. Adversely affect a prehistoric or historic building, structure, or object?
☐	☐	☐	3. Cause an adverse physical or aesthetic effect on an eligible or contributing building, structure, object, or cultural landscape?
☐	☐	☐	4. Diminish the informational or research potential of a cultural resource?
☐	☐	☐	5. Increase the potential for vandalism or looting?
☐	☐	☐	6. Disturb any human remains?
☐	☐	☐	7. Restrict access to a sacred site or inhibit the traditional religious practice of a Native American community?

YES	MAYBE	NO	**G. AESTHETIC RESOURCES** – *WILL THE PROJECT:*
☐	☐	☐	1. Adversely affect a scenic vista or view?
☐	☐	☐	2. Significantly increase noise levels?
☐	☐	☐	3. Adversely affect the quality of the scenic resources in the immediate area or park-wide?
☐	☐	☐	4. Create a visually offensive site?
☐	☐	☐	5. Be incompatible with the park design established for this unit or diminish the intended sense of “a special park quality” for the visitor?

YES	MAYBE	NO	**H. RECREATIONAL RESOURCES** – *WILL THE PROJECT:*
☐	☐	☐	1. Be in a public use area?
☐	☐	☐	2. Have an adverse effect on the quality of the intended visitor experience?
☐	☐	☐	3. Have an adverse effect on the quality or quantity of existing or future recreational opportunities or facilities?
☐	☐	☐	4. Have an adverse effect on the accessibility of recreational facilities (e.g., ADA requirements)?

EVALUATION AND COMMENTS

Project ID No. ________________

PROJECT EVALUATION (PEF)

PCA No. ________________

ENVIRONMENTAL REVIEW

To Be Completed by Qualified Specialist(s) ONLY.
Attach additional reviews or continuation pages, as necessary.

ARCHEOLOGIST COMMENTS ☐ No Significant Impact ☐ Conditions, Mitigation ☐ Potential Impact	
SIGNATURE	PRINTED NAME
TITLE	DATE
HISTORIAN COMMENTS ☐ No Significant Impact ☐ Conditions, Mitigation ☐ Potential Impact	
SIGNATURE	PRINTED NAME
TITLE	DATE
RESOURCE ECOLOGIST COMMENTS ☐ No Significant Impact ☐ Conditions, Mitigation ☐ Potential Impact	
SIGNATURE	PRINTED NAME
TITLE	DATE
MAINTENANCE CHIEF/SUPERVISOR COMMENTS ☐ No Significant Impact ☐ Conditions, Mitigation ☐ Potential Impact	
SIGNATURE	PRINTED NAME
TITLE	DATE
OTHER SPECIALIST COMMENTS ☐ No Significant Impact ☐ Conditions, Mitigation ☐ Potential Impact	
SIGNATURE	PRINTED NAME
TITLE	DATE
OTHER COMMENTS ☐ No Significant Impact ☐ Conditions, Mitigation ☐ Potential Impact	
SIGNATURE	PRINTED NAME
TITLE	DATE

ENVIRONMENTAL COORDINATOR REVIEW

Project ID No. _______________

PROJECT EVALUATION (PEF)

PCA No. _______________

YES	MAYBE	NO	**CUMULATIVE IMPACTS**
☐	☐	☐	1. Will the project be conducted in conjunction with or at the same time as other projects at the park?
☐	☐	☐	2. Will the project be part of a series of inter-related projects?
☐	☐	☐	3. Are there any other projects that must be completed for any part of this project to become operational?
☐	☐	☐	4. Are there any other projects (including deferred maintenance) that have been completed or any probable future projects that could contribute to the cumulative impacts of this project?
☐	☐	☐	5. Are any of the projects that relate to the proposed work outside the General Plan?

COMMENTS:

RECOMMENDATION:

☐ Not a project for the purposes of CEQA compliance.
☐ The project is exempt. A Notice of Exemption should be filed.
☐ A Negative Declaration should be prepared.
☐ A Mitigated Negative Declaration should be prepared.
☐ An EIR should be prepared.

SIGNATURE	PRINTED NAME
TITLE	DATE

DISTRICT SUPERINTENDENT REVIEW

COMMENTS:

I acknowledge any constraints placed on the project as a result of the specialists' comments above and recommend the project proceed.

DISTRICT SUPERINTENDENT APPROVAL SIGNATURE	TITLE	DATE
✍		

Appendix F

Air Quality Modeling Output

11/10/2011 8:20:29 PM

Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Trails Construction Model.urb924

Project Name: Trails Construction Model

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2012 TOTALS (lbs/day unmitigated)	4.78	21.04	11.00	0.01	20.04	0.92	20.97	4.19	0.85	5.04	2,576.44

11/16/2011 1:49:43 PM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Unmitigated Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Appendix\Trails Construction Model.urb924

Project Name: Trails Construction Model

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 2/1/2012-2/28/2012 Active Days: 20	1.82	15.03	9.28	0.00	20.00	0.69	20.70	4.18	0.64	4.82	1,579.05
Fine Grading 02/01/2012-03/14/2012	1.82	15.03	9.28	0.00	20.00	0.69	20.70	4.18	0.64	4.82	1,579.05
Fine Grading Dust	0.00	0.00	0.00	0.00	20.00	0.00	20.00	4.18	0.00	4.18	0.00
Fine Grading Off Road Diesel	1.79	14.85	8.63	0.00	0.00	0.69	0.69	0.00	0.63	0.63	1,481.28
Fine Grading On Road Diesel	0.01	0.15	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	24.17
Fine Grading Worker Trips	0.02	0.04	0.61	0.00	0.00	0.00	0.01	0.00	0.00	0.00	73.60
Time Slice 2/29/2012-3/14/2012 Active Days: 11	**4.78**	**21.04**	**11.00**	**0.01**	**20.04**	**0.92**	**20.97**	**4.19**	**0.85**	**5.04**	**2,576.44**
Asphalt 02/29/2012-03/14/2012	2.96	6.01	1.73	0.01	0.04	0.23	0.27	0.01	0.21	0.22	997.39
Paving Off-Gas	2.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving On Road Diesel	0.34	6.01	1.73	0.01	0.04	0.23	0.27	0.01	0.21	0.22	997.39
Paving Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading 02/01/2012-03/14/2012	1.82	15.03	9.28	0.00	20.00	0.69	20.70	4.18	0.64	4.82	1,579.05
Fine Grading Dust	0.00	0.00	0.00	0.00	20.00	0.00	20.00	4.18	0.00	4.18	0.00
Fine Grading Off Road Diesel	1.79	14.85	8.63	0.00	0.00	0.69	0.69	0.00	0.63	0.63	1,481.28
Fine Grading On Road Diesel	0.01	0.15	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	24.17
Fine Grading Worker Trips	0.02	0.04	0.61	0.00	0.00	0.00	0.01	0.00	0.00	0.00	73.60

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Phase Assumptions

Phase: Fine Grading 2/1/2012 - 3/14/2012 - Default Fine Site Grading Description

Total Acres Disturbed: 5

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 6.45

Off-Road Equipment:

1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

Phase: Paving 2/29/2012 - 3/14/2012 - Default Paving Description

Acres to be Paved: 11

Off-Road Equipment:

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Summary Report for Summer Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\CSP Trails Paving Model.urb924

Project Name: Trails Construction Model

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2012 TOTALS (lbs/day unmitigated)	5.25	20.04	11.37	0.01	20.05	1.41	21.46	4.19	1.30	5.49	2,437.08

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Detail Report for Summer Construction Unmitigated Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Appendix\CSP Trails Paving Model.urb924

Project Name: Trails Construction Model

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 2/1/2012-2/28/2012 Active Days: 20	0.01	0.15	0.05	0.00	20.00	0.01	20.01	4.18	0.01	4.18	25.97
Fine Grading 02/01/2012-03/14/2012	0.01	0.15	0.05	0.00	20.00	0.01	20.01	4.18	0.01	4.18	25.97
Fine Grading Dust	0.00	0.00	0.00	0.00	20.00	0.00	20.00	4.18	0.00	4.18	0.00
Fine Grading Off Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading On Road Diesel	0.01	0.15	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	25.97
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time Slice 2/29/2012-3/14/2012 Active Days: 11	**5.25**	**20.04**	**11.37**	**0.01**	**20.05**	**1.41**	**21.46**	**4.19**	**1.30**	**5.49**	**2,437.08**
Asphalt 02/29/2012-03/14/2012	5.24	19.89	11.32	0.01	0.05	1.40	1.45	0.02	1.29	1.31	2,411.11
Paving Off-Gas	2.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.11	12.91	7.97	0.00	0.00	1.14	1.14	0.00	1.05	1.05	1,115.37
Paving On Road Diesel	0.48	6.93	2.40	0.01	0.04	0.26	0.30	0.01	0.24	0.25	1,193.51
Paving Worker Trips	0.03	0.05	0.94	0.00	0.00	0.00	0.01	0.00	0.00	0.00	102.23
Fine Grading 02/01/2012-03/14/2012	0.01	0.15	0.05	0.00	20.00	0.01	20.01	4.18	0.01	4.18	25.97
Fine Grading Dust	0.00	0.00	0.00	0.00	20.00	0.00	20.00	4.18	0.00	4.18	0.00
Fine Grading Off Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading On Road Diesel	0.01	0.15	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	25.97
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Phase Assumptions

Phase: Fine Grading 2/1/2012 - 3/14/2012 - Default Fine Site Grading Description

Total Acres Disturbed: 5

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 6.45

Off-Road Equipment:

Phase: Paving 2/29/2012 - 3/14/2012 - Default Paving Description

Acres to be Paved: 11

Off-Road Equipment:

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

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Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Appendix\Worker Trips.urb924

Project Name: Trip Rate

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2.73	3.45	29.21	0.03	6.18	1.18	3,341.24

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2.73	3.45	29.21	0.03	6.18	1.18	3,341.24

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Urbemis 2007 Version 9.2.4

Detail Report for Annual Operational Unmitigated Emissions (Tons/Year)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Appendix\Worker Trips.urb924

Project Name: Trip Rate

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Blank (Edit this description)	0.48	0.73	5.40	0.01	1.13	0.21	580.75
TOTALS (tons/year, unmitigated)	0.48	0.73	5.40	0.01	1.13	0.21	580.75

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2013 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Blank (Edit this description)		1.20	acres	100.00	120.00	3,600.00
					120.00	3,600.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	48.5	0.6	99.2	0.2

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Truck < 3750 lbs	10.9	1.8	93.6	4.6
Light Truck 3751-5750 lbs	21.9	0.5	99.5	0.0
Med Truck 5751-8500 lbs	9.6	1.0	99.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.7	0.0	76.5	23.5
Lite-Heavy Truck 10,001-14,000 lbs	0.7	0.0	42.9	57.1
Med-Heavy Truck 14,001-33,000 lbs	1.0	0.0	20.0	80.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.9	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	3.5	54.3	45.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.0	0.0	90.0	10.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	30.0	30.0	30.0	30.0	30.0	30.0
Trip speeds (mph)	45.0	45.0	45.0	45.0	45.0	45.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Blank (Edit this description)				2.0	1.0	97.0

Operational Changes to Defaults

The urban/rural selection has been changed from Urban to Rural

Home-based work average speed changed from 35 mph to 45 mph

Home-based work rural trip length changed from 16.8 miles to 30 miles

Home-based shop average speed changed from 35 mph to 45 mph

Home-based shop rural trip length changed from 7.1 miles to 30 miles

Home-based other average speed changed from 35 mph to 45 mph

Home-based other rural trip length changed from 7.9 miles to 30 miles

Commercial-based commute average speed changed from 35 mph to 45 mph

Commercial-based commute rural trip length changed from 14.7 miles to 30 miles

Commercial-based non-work average speed changed from 35 mph to 45 mph

Commercial-based non-work rural trip length changed from 6.6 miles to 30 miles

Commercial-based customer average speed changed from 35 mph to 45 mph

Commercial-based customer rural trip length changed from 6.6 miles to 30 miles

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Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Appendix\Operational Trips.urb924

Project Name: Operational Trips-Trails

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	13.40	23.35	207.18	0.24	43.09	8.31	24,605.30

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	13.40	23.35	207.18	0.24	43.09	8.31	24,605.30

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Urbemis 2007 Version 9.2.4

Detail Report for Summer Operational Unmitigated Emissions (Pounds/Day)

File Name: P:\Projects\2010\10010034.03 - CA State Parks-Roads-Trails-PEIR\4_Deliverables in progress\Admin Draft PEIR\01_ Prepared by authors\Air\Appendix\Operational Trips.urb924

Project Name: Operational Trips-Trails

Project Location: California State-wide

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
TRAIL CIU	13.40	23.35	207.18	0.24	43.09	8.31	24,605.30
TOTALS (lbs/day, unmitigated)	13.40	23.35	207.18	0.24	43.09	8.31	24,605.30

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2013 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
TRAIL CIU		500.00	acres	1.00	500.00	25,000.00
					500.00	25,000.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	48.5	0.6	99.2	0.2

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Truck < 3750 lbs	10.9	1.8	93.6	4.6
Light Truck 3751-5750 lbs	21.9	0.5	99.5	0.0
Med Truck 5751-8500 lbs	9.6	1.0	99.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.7	0.0	76.5	23.5
Lite-Heavy Truck 10,001-14,000 lbs	0.7	0.0	42.9	57.1
Med-Heavy Truck 14,001-33,000 lbs	1.0	0.0	20.0	80.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.9	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	3.5	54.3	45.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.0	0.0	90.0	10.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	50.0	50.0	50.0	50.0	50.0	50.0
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
TRAIL CIU				2.0	1.0	97.0

Operational Changes to Defaults

The urban/rural selection has been changed from Urban to Rural

Home-based work rural trip length changed from 16.8 miles to 50 miles

Home-based shop rural trip length changed from 7.1 miles to 50 miles

Home-based other rural trip length changed from 7.9 miles to 50 miles

Commercial-based commute rural trip length changed from 14.7 miles to 50 miles

Commercial-based non-work rural trip length changed from 6.6 miles to 50 miles

Commercial-based customer rural trip length changed from 6.6 miles to 50 miles

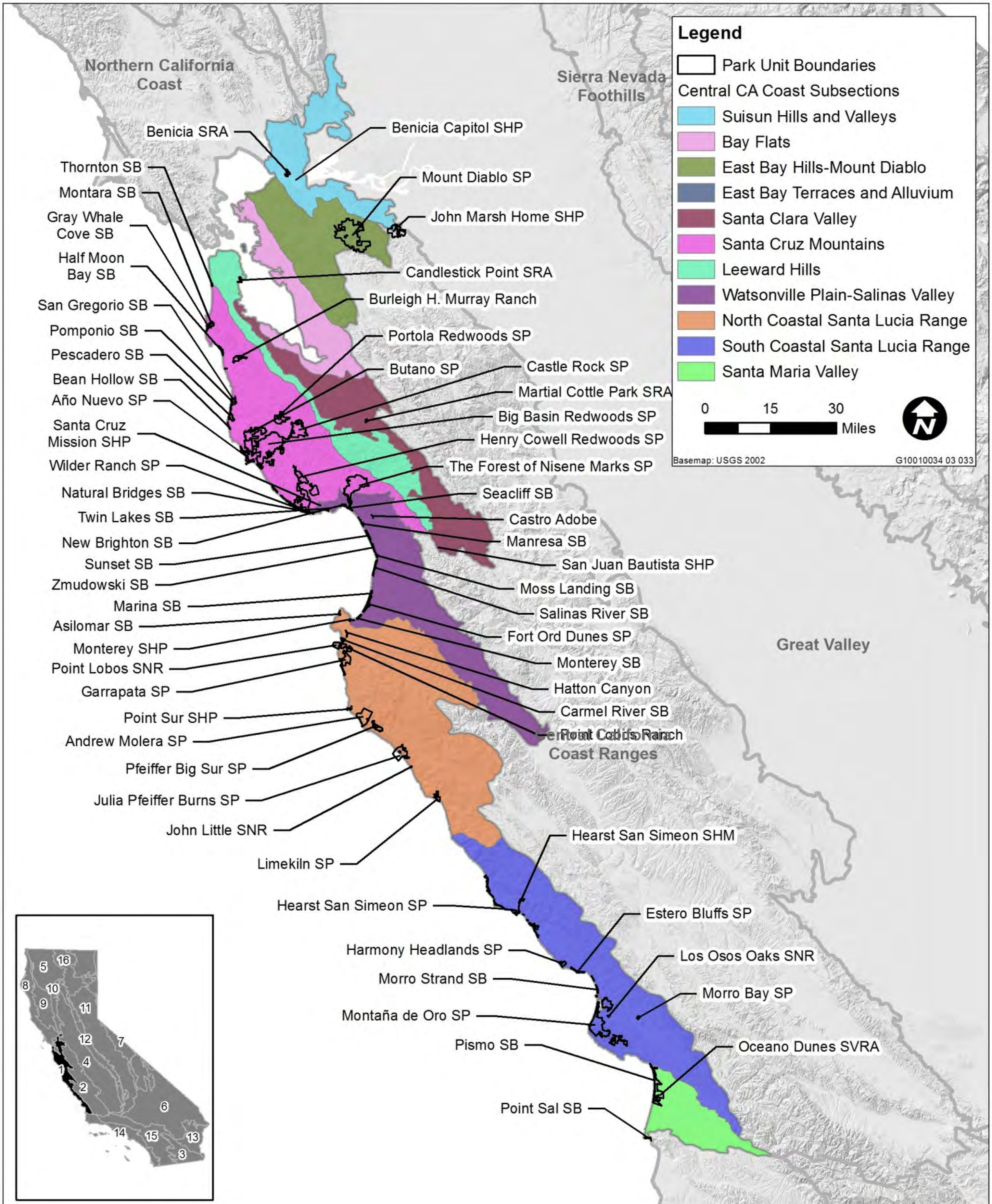
Appendix G

USFS Ecological Section and Subsection Maps

APPENDIX G
USFS ECOLOGICAL SECTION AND SUBSECTION MAPS

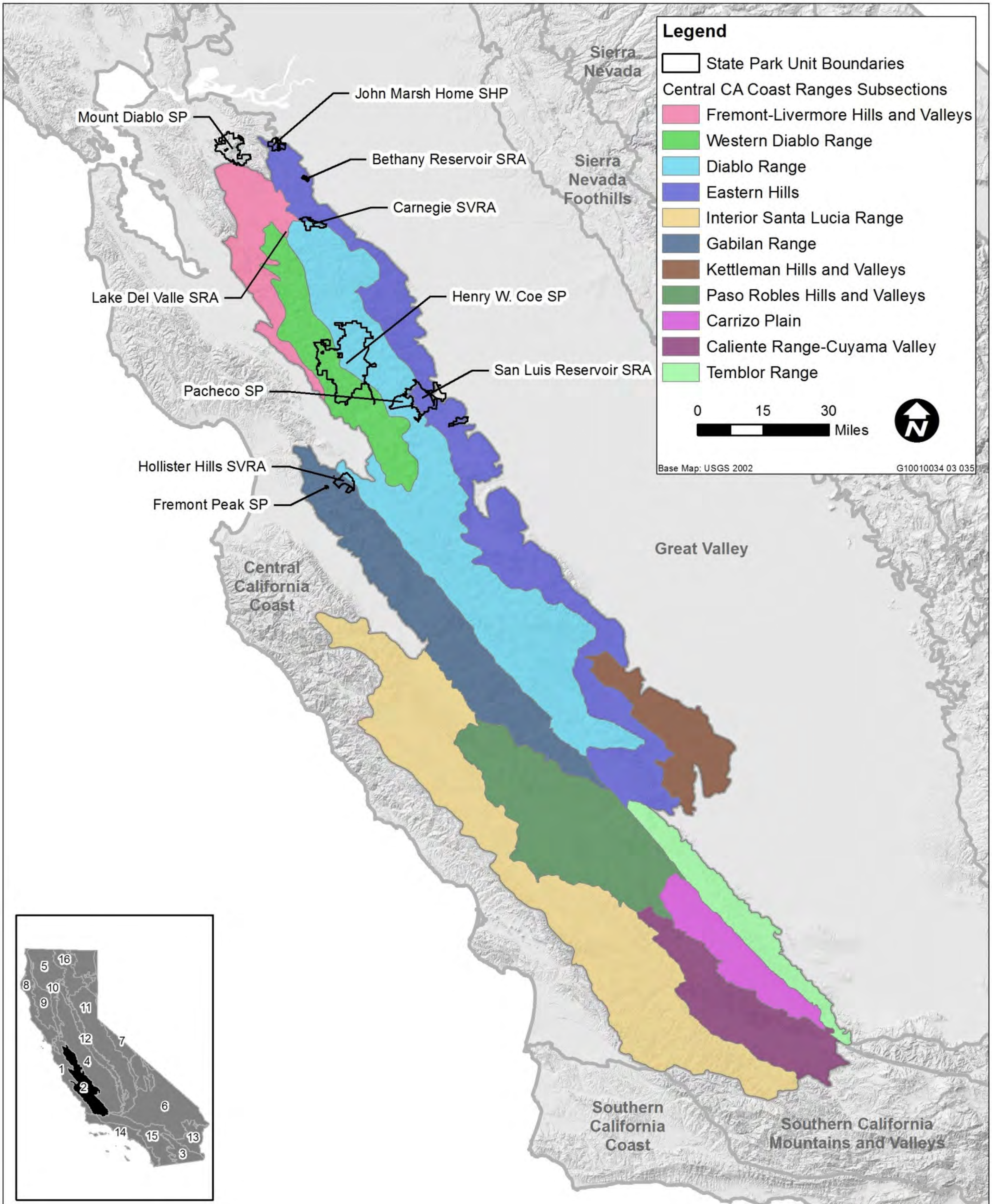
Index

Map Number	Ecological Section
1	Central California Coast
2	Central California Coast Ranges
3	Colorado Desert
4	Great Valley
5	Klamath
6	Mojave Desert
7	Mono
8	Northern California Coast
9	Northern California Coast Ranges
10	Northern California Interior Coast Ranges
11	Sierra Nevada
12	Sierra Nevada Foothills
13	Sonoran Desert
14	Southern California Coast
15	Southern California Mountains and Valleys
16	Southern Cascades



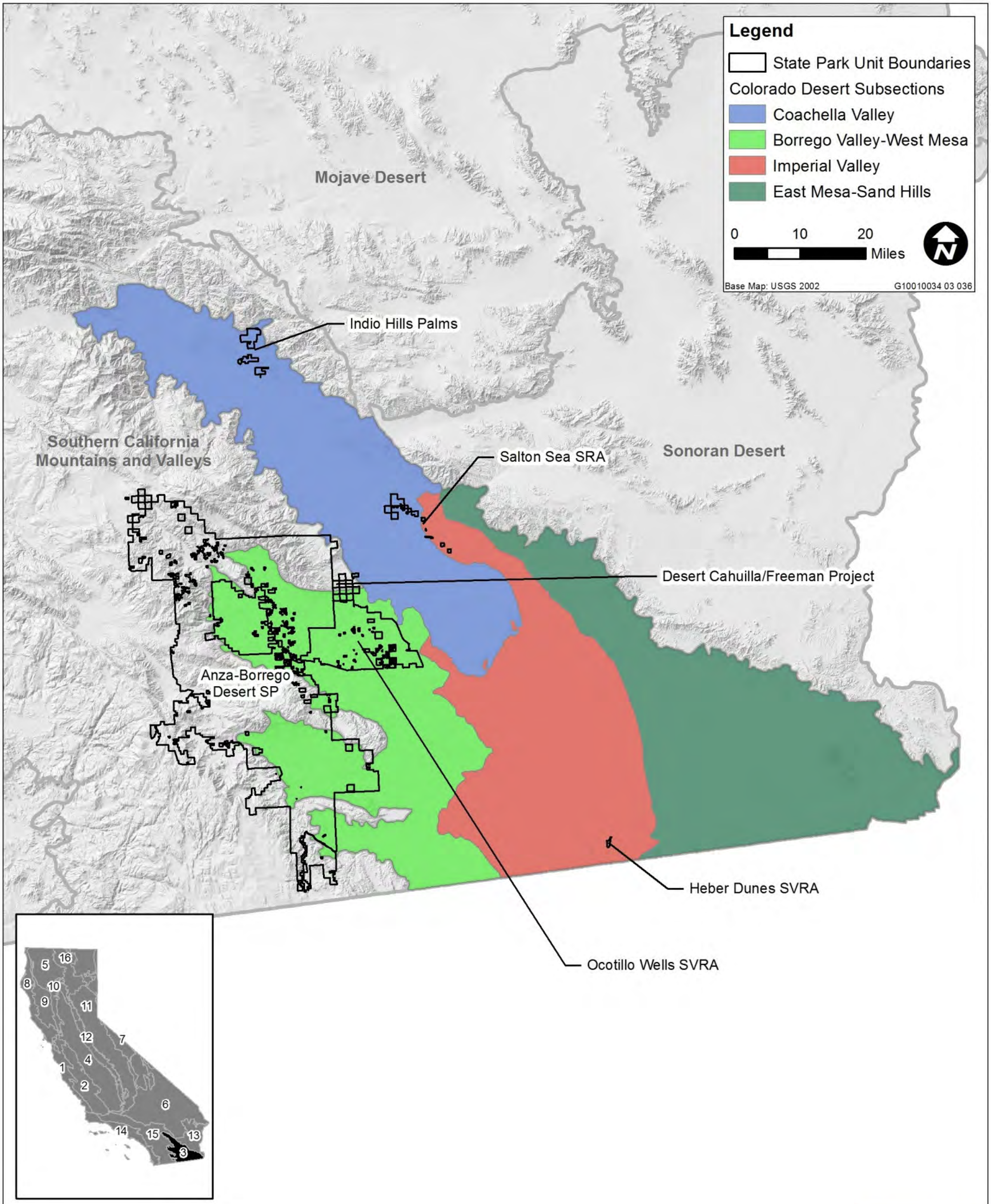
Map 1

Central California Coast



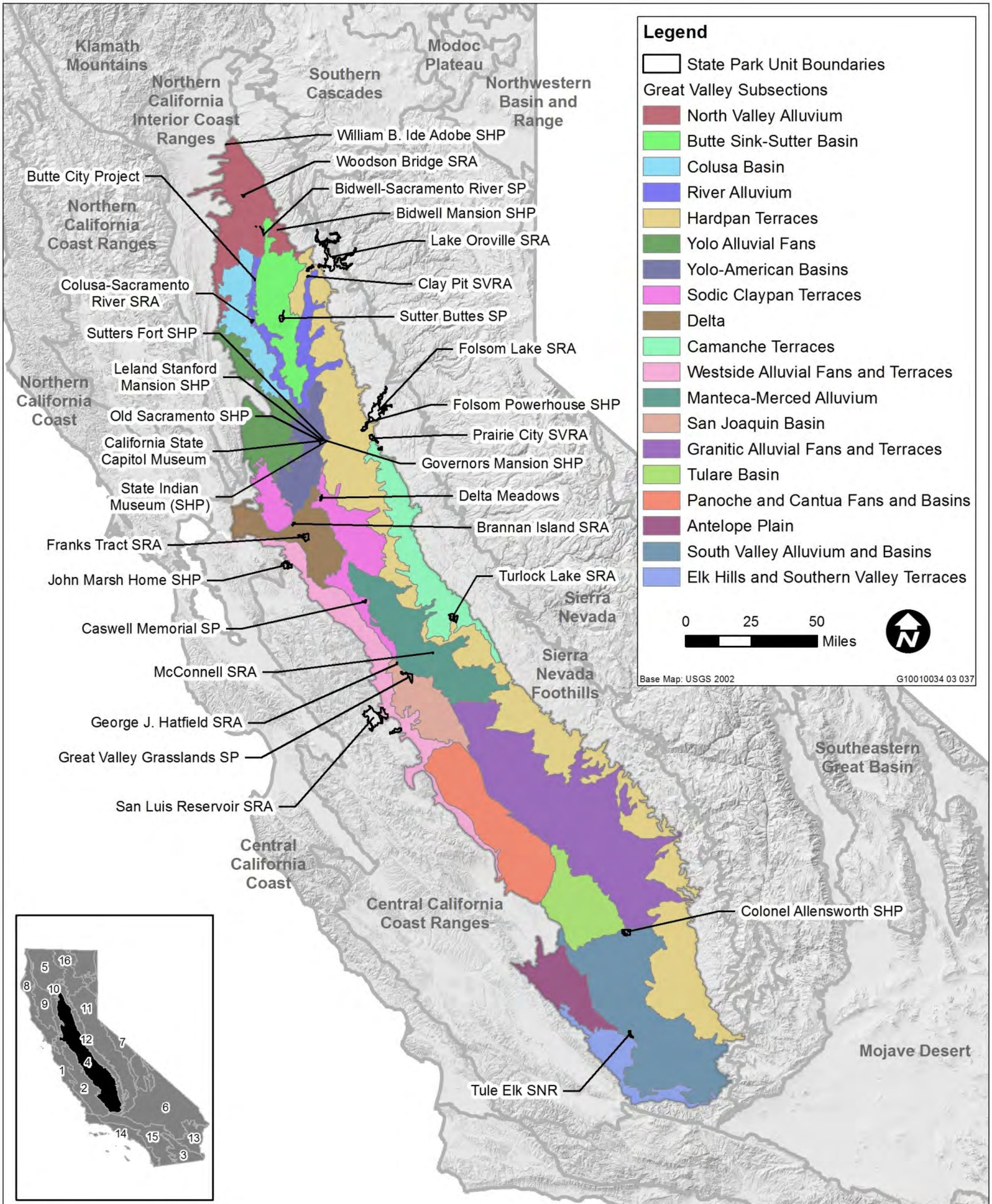
Map 2

Central California Coast Ranges



Map 3

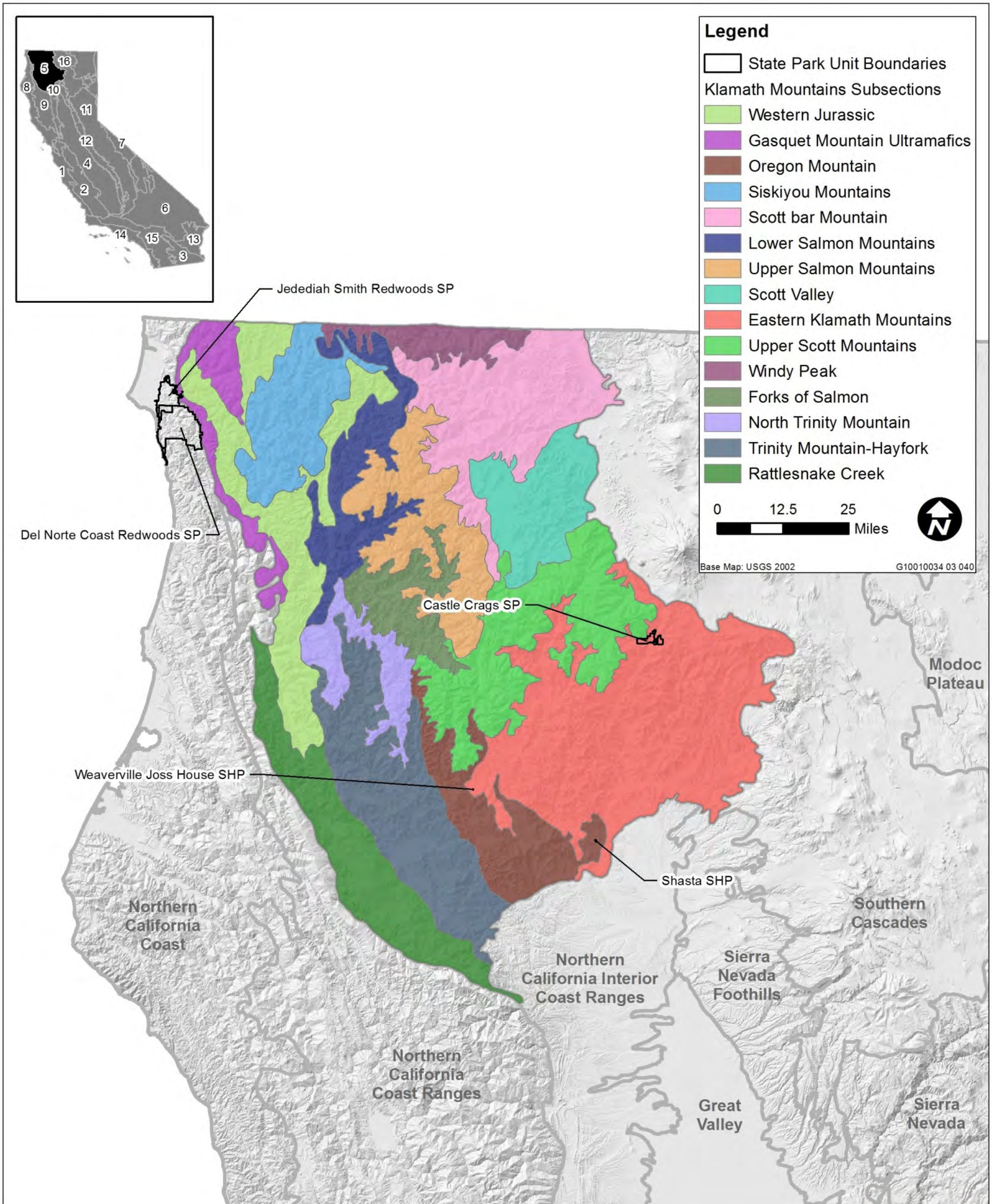
Colorado Desert



Map 4

Great Valley

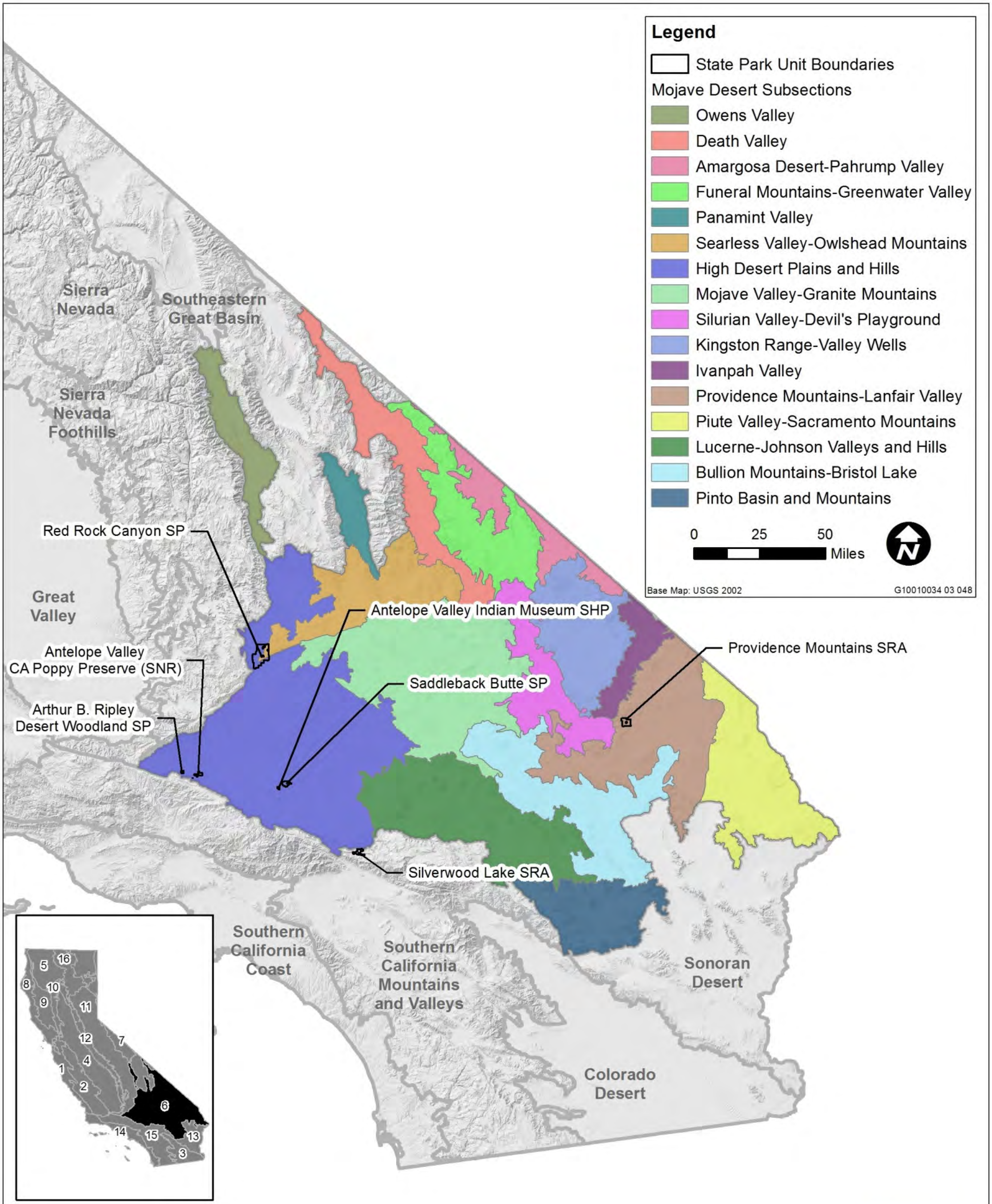
ASCENT ENVIRONMENTAL



Map 5

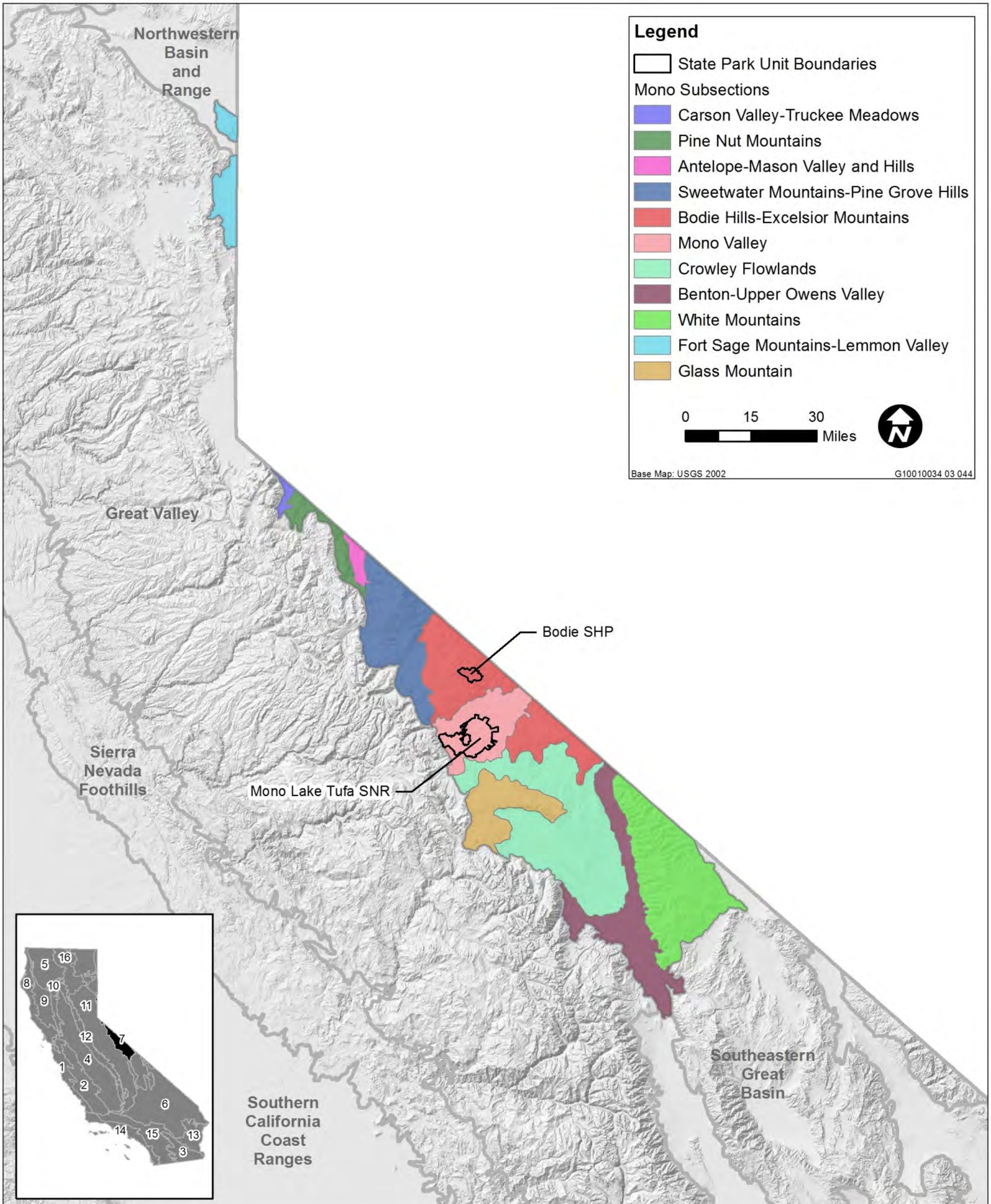
Klamath

ASCENT ENVIRONMENTAL



Map 6

Mojave Desert


Legend
State Park Unit Boundaries
Mono Subsections
Carson Valley-Truckee Meadows
Pine Nut Mountains
Antelope-Mason Valley and Hills
Sweetwater Mountains-Pine Grove Hills
Bodie Hills-Excelsior Mountains
Mono Valley
Crowley Flowlands
Benton-Upper Owens Valley
White Mountains
Fort Sage Mountains-Lemmon Valley
Glass Mountain
0 15 30 Miles
N
Base Map: USGS 2002
G10010034 03 044
Northwestern Basin and Range
Great Valley
Sierra Nevada Foothills
Bodie SHP
Mono Lake Tufa SNR
Southern California Coast Ranges
Southeastern Great Basin
16
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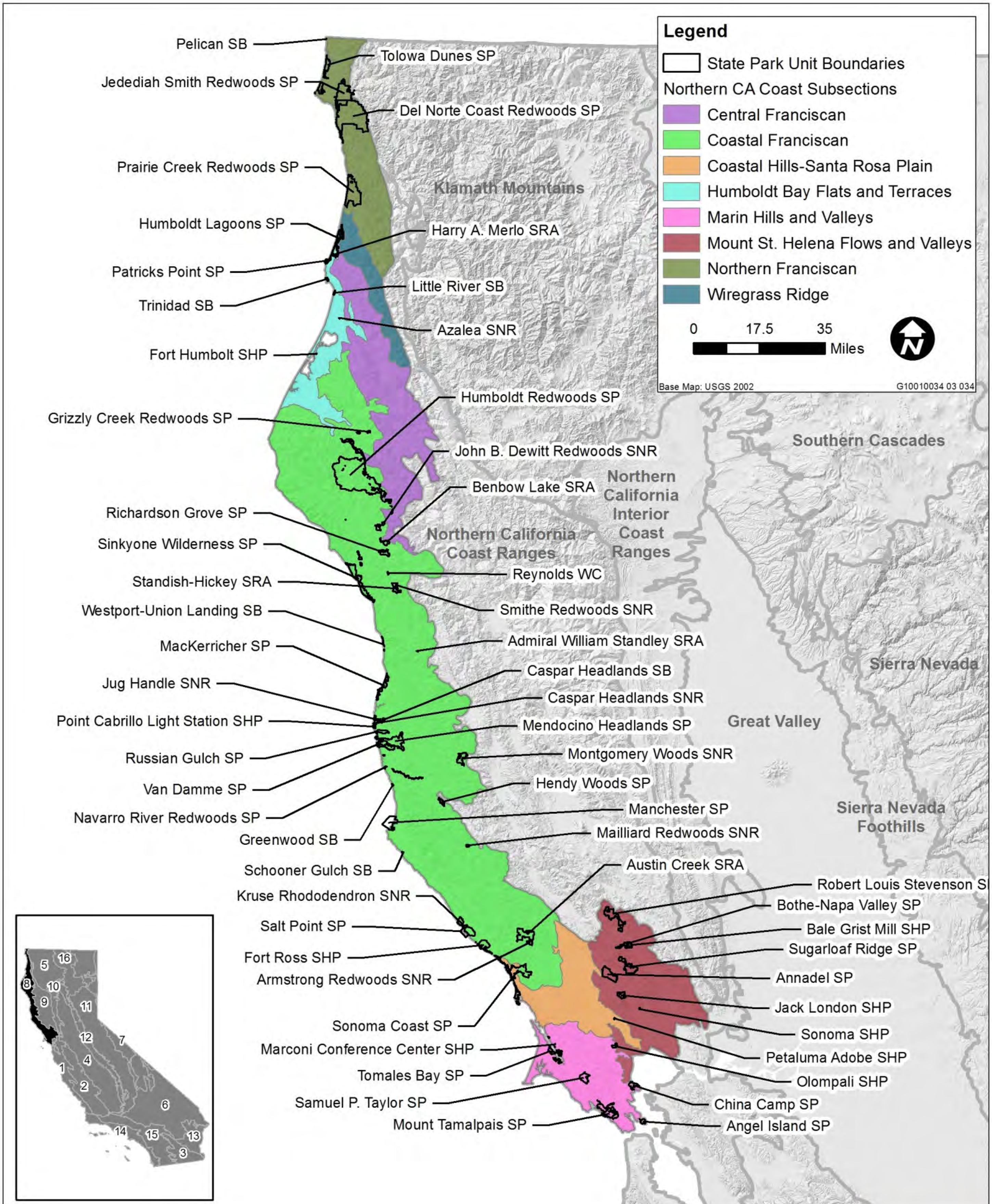
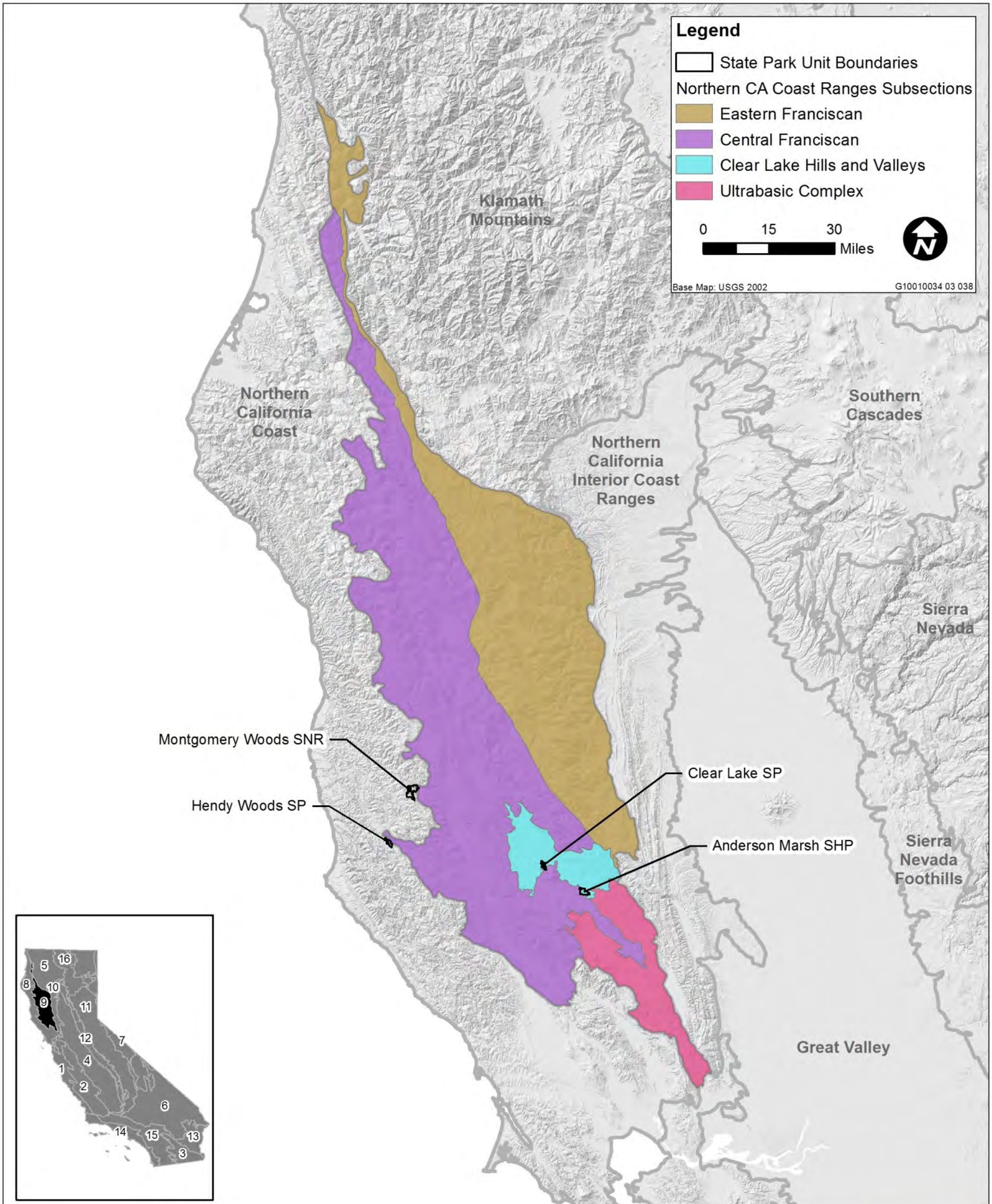
Map 7

Mono

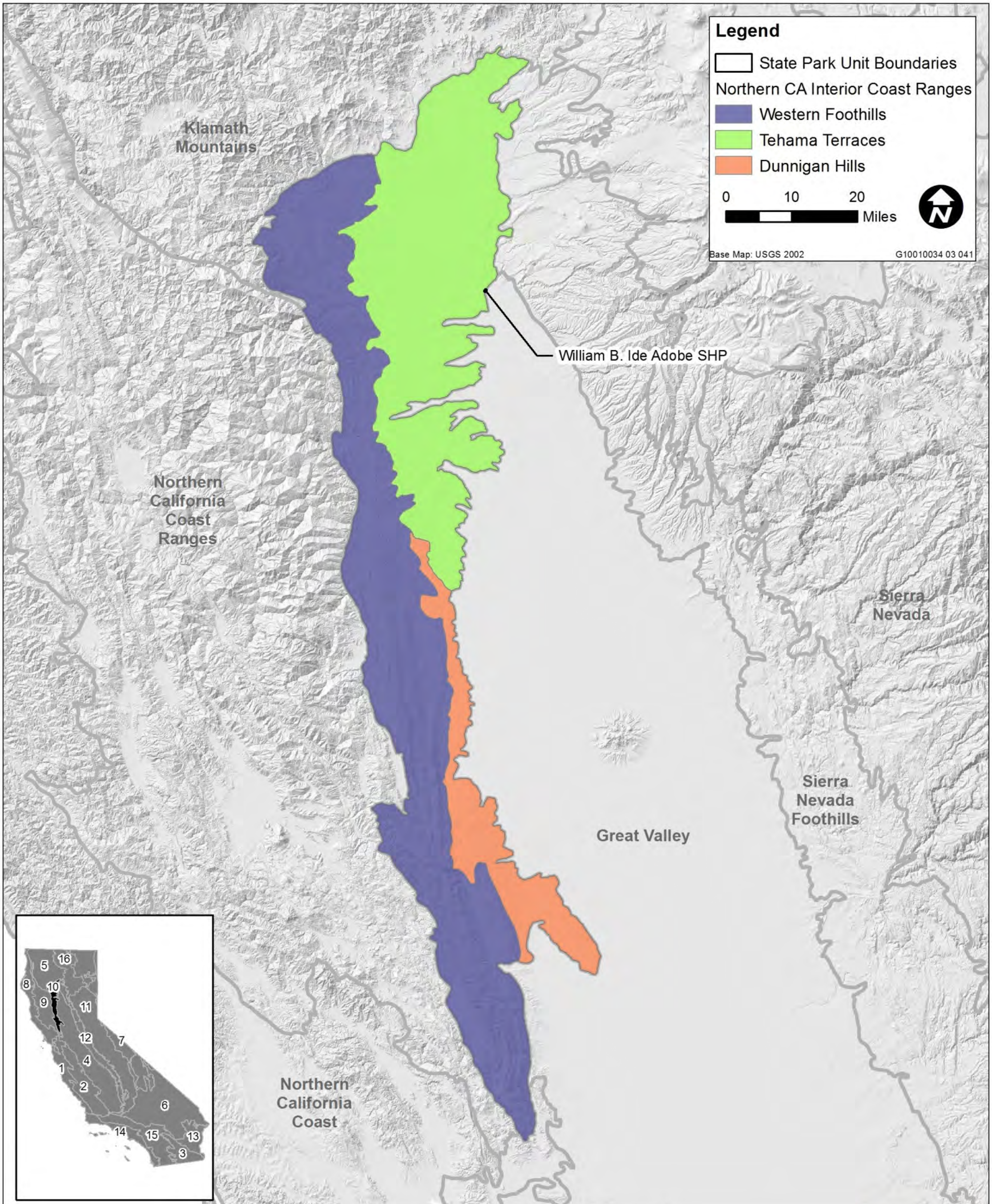


Map 8 Northern California Coast

ASCENT ENVIRONMENTAL

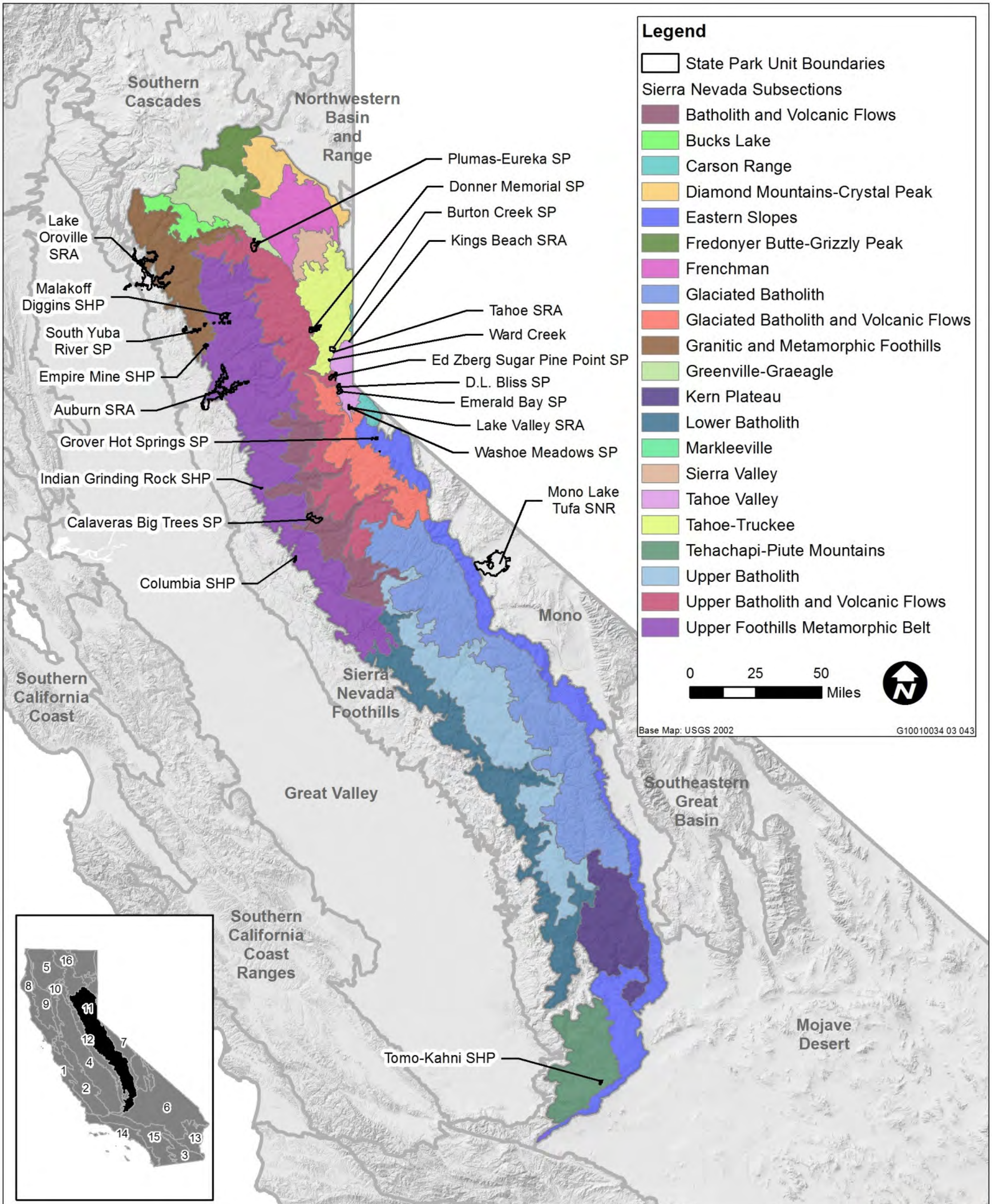


Map 9 Northern California Coast Ranges



Map 10

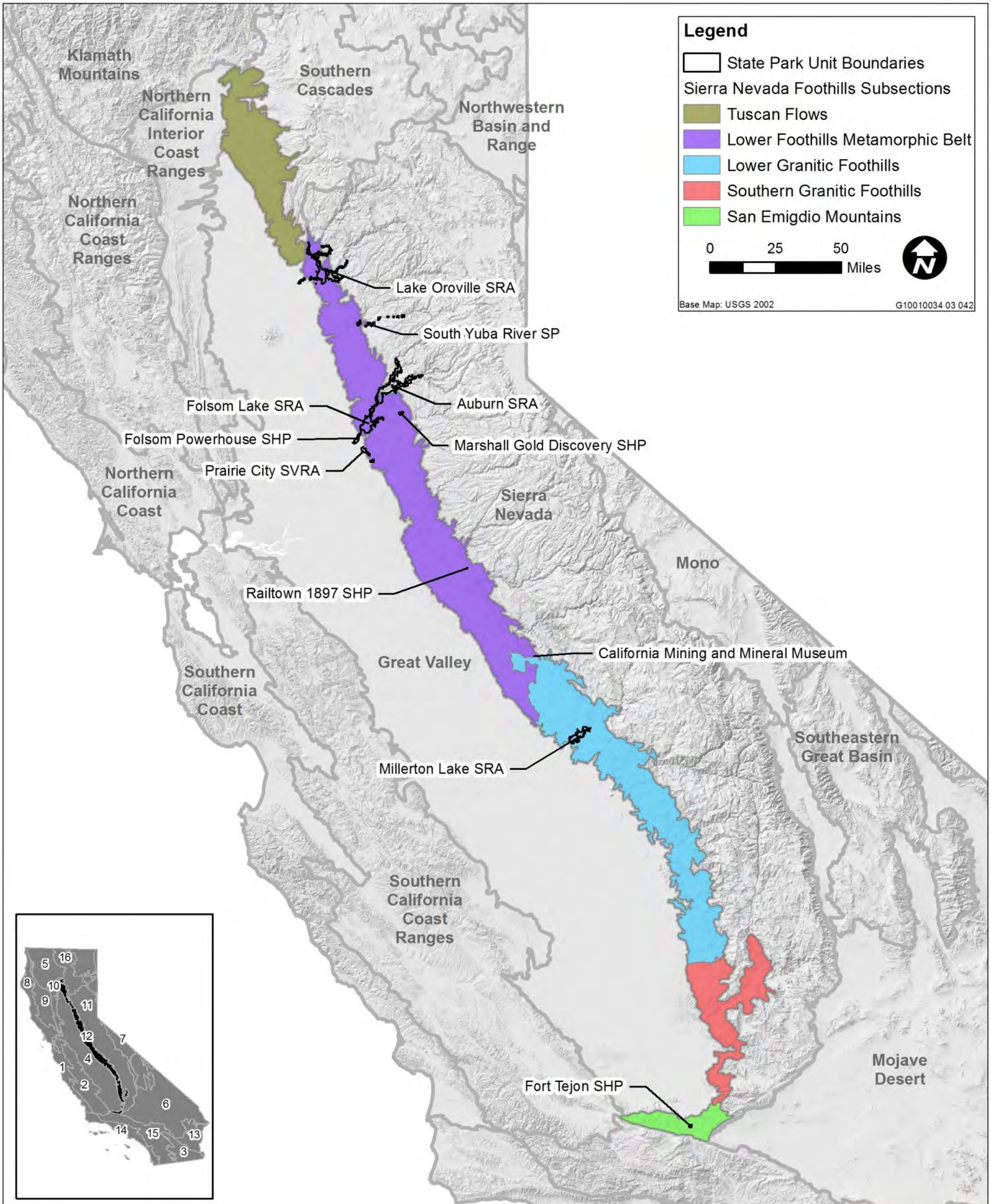
Northern California Interior Coast Ranges



Map 11

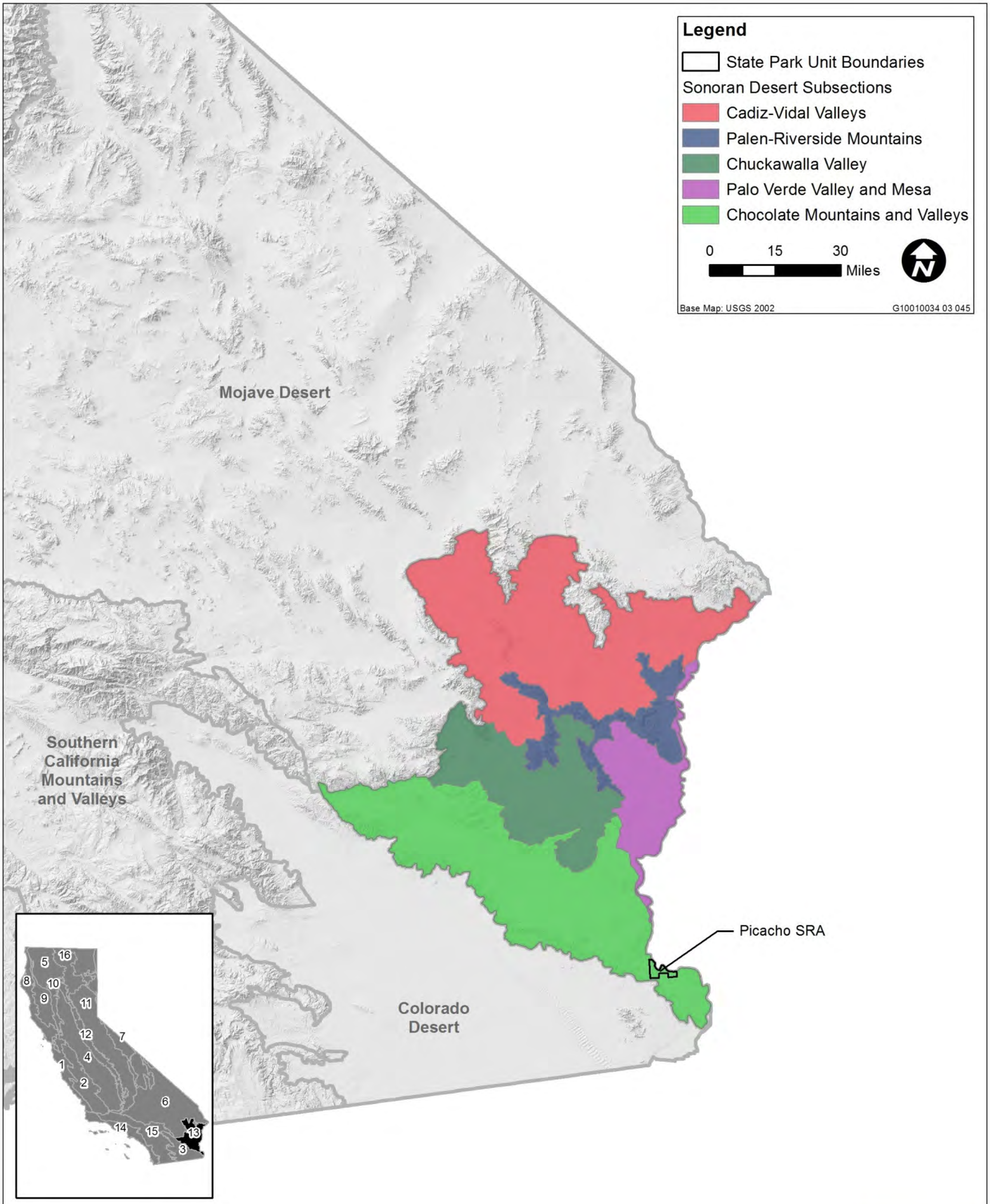
Sierra Nevada

ASCENT ENVIRONMENTAL



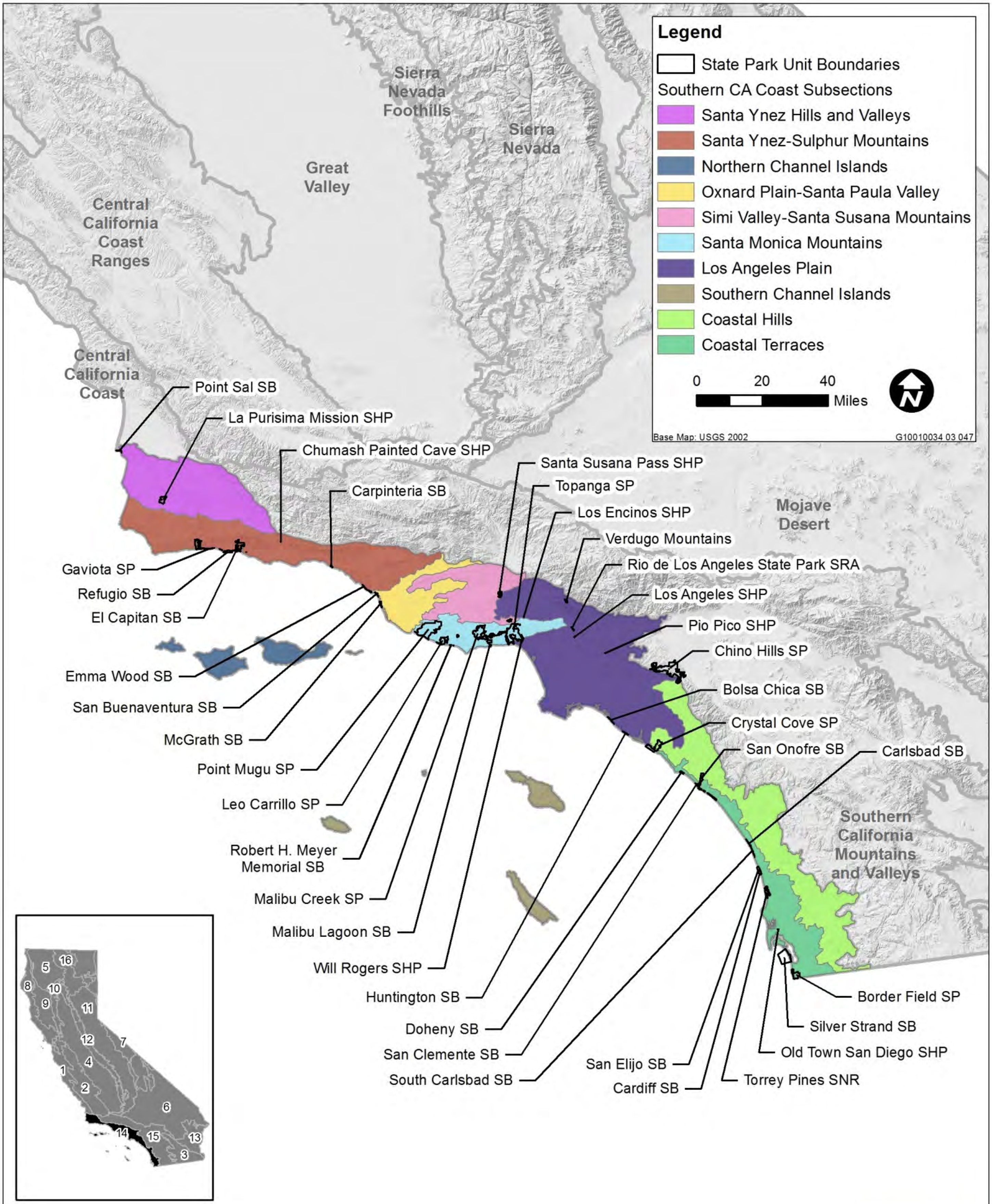
Map 12

Sierra Nevada Foothills



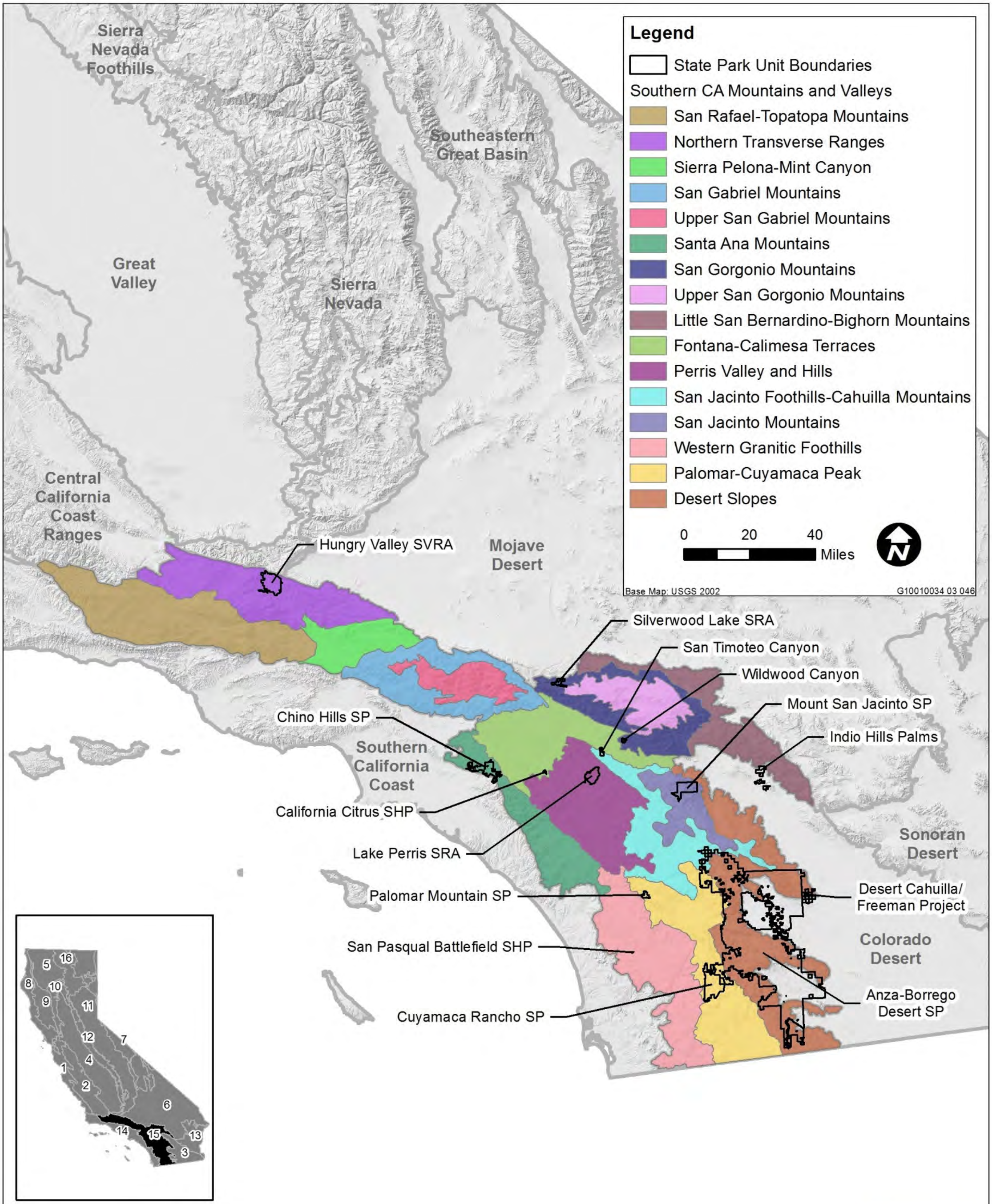
Map 13

Sonoran Desert

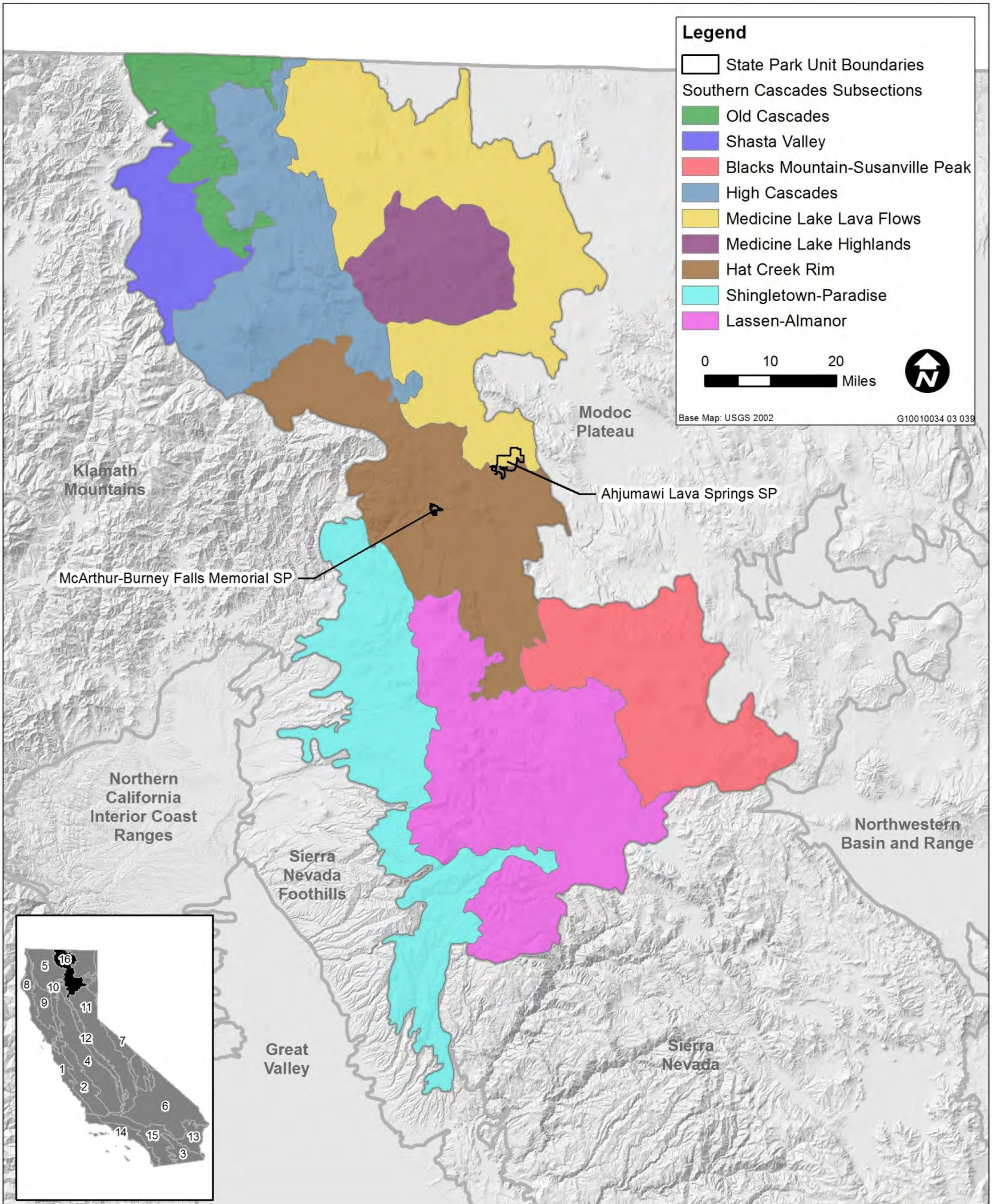


Map 14

Southern California Coast



Map 15 Southern California Mountains and Valleys



Map 16

Southern Cascades

Appendix H

Summary of State Park Unit by Ecological Section and Subsection

Table H-1. Summary of State Park Unit By Ecological Section and Subsection

Ecological Section and Subsection

State Park Unit	Central California Coast									Central California Coast Ranges					Colorado Desert			Great Valley														Klamath Mountains					Mojave Desert			Mono		Northern California Coast								Northern California Coast Ranges		Northern California Interior Coast Ranges	Sierra Nevada										Sierra Nevada Foothills			Sonoran Desert	Southern California Coast								Southern California Mountains and Valleys												Southern Cascades	
	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley	Diablo Range	Eastern Hills	Fremont-Livermore Hills and Valleys	Gabilan Range	Western Diablo Range	Borrego Valley-West Mesa	Coachella Valley	Imperial Valley	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins	Eastern Klamath Mountains	Gasquet Mountain Ultramafics	Oregon Mountain	Upper Scott Mountains	Western Jurassic	High Desert Plains and Hills	Providence Mountains-Lanfair Valley	Searles Valley-Owlshead Mountains	Bodie Hills-Excelsior Mountains	Mono Valley	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge	Central Franciscan	Clear Lake Hills and Valleys	Tehama Terraces	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt	Lower Foothills Metamorphic Belt	Lower Granitic Foothills	San Emigdio Mountains	Chocolate Mountains and Valleys	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains	Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Peak	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills	Hat Creek Rim	Medicine Lake Lava Flows
Admiral William Standley SRA																																											X																																													
Ahjumawi Lava Springs SP																																																																																								X	X
Anderson Marsh SHP																																																		X	X																																									
Andrew Molera SP			X																																																																																							
Angel Island SP																																														X																																														
Annadel SP																																															X																																													
Ano Nuevo SP					X																																																																																					
Antelope Valley Ca Poppy Preserve (SNR)																																					X																																																										
Antelope Valley Indian Museum SHP																																					X																																																										
Anza-Borrego Desert SP															X	X																																																													X				X			X						
Armstrong Redwoods SNR																																											X																																														
Arthur B. Ripley Desert Woodland SP																																					X																																																									
Asilomar SB			X																																																																																								
Auburn SRA																																																														X	X																												
Austin Creek SRA																																											X																																															
Azalea SNR																																													X																																														
Bale Grist Mill SHP																																															X																																													
Bean Hollow SB					X																																																																																						
Benbow Lake SRA																																											X																																															
Benicia Capitol SHP								X																																																																																				
Benicia SRA								X																																																																																				
Bethany Reservoir SRA											X																																																																																	
Bidwell Mansion SHP																								X																																																																				
Bidwell-Sacramento River SP																								X																																																																				
Big Basin Redwoods SP					X																																																																																					
Bodie SHP																																								X																																																								
Bolsa Chica SB																																																																								X																				
Border Field SP																																																																							X																					
Bothe-Napa Valley SP																																															X																																														
Brannan Island SRA																				X																																																																										
Burleigh H. Murray Ranch					X																																																																																					
Burton Creek SP																																																											X																																		
Butano SP					X																																																																																						
Butte City Project																									X																																																																		
Calaveras Big Trees SP																																																					X																																								
California Citrus SHP																																																																															X												
California Mining and Mineral Museum																																																															X																												
California State Capitol Museum																															X																																																														
Candlestick Point SRA		X																																																																																										
Cardiff SB																																																																					X																					
Carlsbad SB																																																																					X																					
Carmel River SB			X																																																																																								
Carnegie SVRA										X	X																																																																																		
Carpinteria SB																																																																									X															
Caspar Headlands SB																																											X																																																
Caspar Headlands SNR																																											X																																																
Castle Crags SP																																X			X																																																											
Castle Rock SP					X																																																																																						
Castro Adobe									X																																																																																		
Caswell Memorial SP																											X																																																																	
China Camp SP																																														X	X																																													
Chino Hills SP																																																																				X		X																X					
Chumash Painted Cave SHP																																																																										X															
Clay Pit SVRA																						X																																																																									
Clear Lake SP																																																		X	X																																									
Colonel Allensworth SHP																					X							X	X																																																																		
Columbia SHP																																																														X																													
Colusa-Sacramento River SRA																									X																																																																			
Crystal Cove SP																																																																				X	X	X																						
Cuyamaca Rancho SP																																																																																	X									
D.L. Bliss SP																																																							X			X			X																																	
Del Norte Coast Redwoods SP																																	X																X																																														
Delta Meadows																											X																																																																		
Desert Cahuilla/Freeman Project															X																																																															X													
Doheny SB																																																																					X																					
Donner Memorial SP																																																											X		X																																
Ed Zberg Sugar Pine Point SP																																																									X			X																																	
El Capitan SB																																																																									X															
Emerald Bay SP																																																										X																																				
Emma Wood SB																																																																							X			X															
Empire Mine SHP																																																								X						X																													
Estero Bluffs SP							X																																																																																				
Folsom Lake SRA																						X																																									X																												
Folsom Powerhouse SHP																						X																																									X																												
Fort Humboldt SHP																																													X																																														
Fort Ord Dunes SP									X																																																																																		
Fort Ross SHP																																											X																																																
Fort Tejon SHP																																																																	X																										
Franks Tract SRA																				X																																																																										
Fremont Peak SP													X																																																																																
Garrapata SP			X																																																																																									
Gaviota SP																																																																										X															
George J. Hatfield SRA																							X			X																																																																				
Governors Mansion SHP																															X																																																														
Gray Whale Cove SB					X																																																																																						
Great Valley Grasslands SP																							X			X																																																																				

Table H-1. Summary of State Park Unit By Ecological Section and Subsection

State Park Unit	Ecological Section and Subsection																																																																																					
	Central California Coast									Central California Coast Ranges					Colorado Desert			Great Valley														Klamath Mountains					Mojave Desert			Mono		Northern California Coast								Northern California Coast Ranges		Northern California Interior Coast Ranges	Sierra Nevada										Sierra Nevada Foothills			Sonoran Desert	Southern California Coast								Southern California Mountains and Valleys												Southern Cascades	
	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley	Diablo Range	Eastern Hills	Fremont-Livermore Hills and Valleys	Gabilan Range	Western Diablo Range	Borrego Valley-West Mesa	Coachella Valley	Imperial Valley	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins	Eastern Klamath Mountains	Gasquet Mountain Ultramafics	Oregon Mountain	Upper Scott Mountains	Western Jurassic	High Desert Plains and Hills	Providence Mountains-Lanfair Valley	Searles Valley-Owlshead Mountains	Bodie Hills-Excelsior Mountains	Mono Valley	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge	Central Franciscan	Clear Lake Hills and Valleys	Tehama Terraces	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt	Lower Foothills Metamorphic Belt	Lower Granitic Foothills	San Emigdio Mountains	Chocolate Mountains and Valleys	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains	Desert Slopes	Fontana Plain-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Peak	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills	Hat Creek Rim	Medicine Lake Lava Flows
Greenwood SB																																											X																																														
Grizzly Creek Redwoods SP																																											X																																														
Grover Hot Springs SP																																																							X																																						
Half Moon Bay SB					X																																																																																						
Harmony Headlands SP							X																																																																																			
Harry A. Merlo SRA																																										X			X																																															
Hatton Canyon			X																																																																																										
Hearst San Simeon SHM							X																																																																																		
Hearst San Simeon SP							X																																																																																		
Heber Dunes SVRA																	X																																																																								
Hendy Woods SP																																											X							X																																											
Henry Cowell Redwoods SP					X																																																																																					
Henry W. Coe SP										X				X																																																																												
Hollister Hills SVRA										X			X																																																																												
Humboldt Lagoons SP																																										X			X				X																																										
Humboldt Redwoods SP																																										X	X																																																
Hungry Valley SVRA																																																																																	X										
Huntington SB																																																																								X																			
Indian Grinding Rock SHP																																																																X																										
Indio Hills Palms																X																																																															X											
Jack London SHP																																															X																																													
Jedediah Smith Redwoods SP																																	X			X											X																																												
John B. Dewitt Redwoods SNR																																											X																																															
John Little SNR			X																																																																																										
John Marsh Home SHP								X			X																			X																																																														
Jug Handle SNR																																											X																																															
Julia Pfeiffer Burns SP			X																																																																																									
Kings Beach SRA																																																											X	X																															
Kruse Rhododendron SNR																																											X																																															
La Purisima Mission SHP																																																																									X																
Lake Del Valle SRA												X																																																																														
Lake Oroville SRA																						X																																		X							X																									
Lake Perris SRA																																																																																			X								
Lake Valley SRA																																																											X																																		
Leland Stanford Mansion SHP																															X																																																												
Leo Carrillo SP																																																																									X																	
Limekiln SP			X																																																																																									
Little River SB																																													X																																															
Los Angeles SHP																																																																								X																			
Los Encinos SHP																																																																								X																			
Los Osos Oaks SNR							X																																																																																			
MacKerricher SP																																											X																																															
Mailliard Redwoods SNR																																											X																																															
Malakoff Diggins SHP																																																															X																										
Malibu Creek SP																																																																									X																	
Malibu Lagoon SB																																																																									X																	
Manchester SP																																											X																																															
Manresa SB									X																																																																																			
Marconi Conference Center SHP																																														X																																														
Marina SB									X																																																																																			
Marshall Gold Discovery SHP																																																																X																									
Martial Cottle Park SRA				X																																																																																							
McArthur-Burney Falls Memorial SP																																																																																									X	
McConnell SRA																							X																																																																					
McGrath SB																																																																									X																		
Mendocino Headlands SP																																											X																																															
Millerton Lake SRA																																																																	X																								
Mono Lake Tufa SNR																																									X												X																																						
Montana de Oro SP							X																																																																																				
Montara SB					X																																																																																								
Monterey SB			X						X																																																																																			
Monterey SHP			X																																																																																										
Montgomery Woods SNR																																											X							X																																											
Morro Bay SP							X																																																																																				
Morro Strand SB							X																																																																																				
Moss Landing SB									X																																																																																			
Mount Diablo SP	X											X																																																																																
Mount San Jacinto SP																																																																													X								X					
Mount Tamalpais SP																																														X																																														
Natural Bridges SB									X																																																																																				
Navarro River Redwoods SP																																											X																																															
New Brighton SB									X																																																																																				
Oceano Dunes SVRA						X																																																																																					
Ocotillo Wells SVRA															X																																																																											
Old Sacramento SHP																															X																																																												
Old Town San Diego SHP																																																																						X																				
Olompali SHP																																														X	X																																													
Pacheco SP										X	X																																																																																		
Palomar Mountain SP																																																																																		X									
Patricks Point SP																																													X																																															
Pelican SB																																																X																																													
Pescadero SB					X																																																																																							
Petaluma Adobe SHP																																												X																																																
Pfeiffer Big Sur SP			X																																																																																										
Picacho SRA																																																																			X																						
Pio Pico SHP																																																																								X																			

Table H-1. Summary of State Park Unit By Ecological Section and Subsection

Ecological Section and Subsection

State Park Unit	Central California Coast									Central California Coast Ranges					Colorado Desert		
	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley	Diablo Range	Eastern Hills	Fremont-Livermore Hills and Valleys	Gabilan Range	Western Diablo Range	Borrego Valley-West Mesa	Coachella Valley	Imperial Valley
Pismo SB						X	X										
Plumas-Eureka SP																	
Point Cabrillo Light Station SHP																	
Point Lobos Ranch			X														
Point Lobos SNR			X														
Point Mugu SP																	
Point Sal SB						X											
Point Sur SHP			X														
Pomponio SB					X												
Portola Redwoods SP					X												
Prairie City SVRA																	
Prairie Creek Redwoods SP																	
Providence Mountains SRA																	
Railtown 1897 SHP																	
Red Rock Canyon SP																	
Refugio SB																	
Reynolds WC																	
Richardson Grove SP																	
Rio de Los Angeles State Park SRA																	
Robert H. Meyer Memorial SB																	
Robert Louis Stevenson SP																	
Russian Gulch SP																	
Saddleback Butte SP																	
Salinas River SB									X								
Salt Point SP																	
Salton Sea SRA																X	X
Samuel P. Taylor SP																	
San Buenaventura SB																	
San Clemente SB																	
San Elijo SB																	
San Gregorio SB					X												
San Juan Bautista SHP				X													
San Luis Reservoir SRA										X	X						
San Onofre SB																	
San Pasqual Battlefield SHP																	
San Timoteo Canyon																	
Santa Cruz Mission SHP									X								
Santa Susana Pass SHP																	
Schooner Gulch SB																	
Seacliff SB									X								
Shasta SHP																	
Silver Strand SB																	
Silverwood Lake SRA																	
Sinkyone Wilderness SP																	
Smithe Redwoods SNR																	
Sonoma Coast SP																	
Sonoma SHP																	
South Carlsbad SB																	
South Yuba River SP																	
Standish-Hickey SRA																	
State Indian Museum (SHP)																	
Sugarloaf Ridge SP																	
Sunset SB									X								
Sutter Buttes SP																	
Sutters Fort SHP																	
Tahoe SRA																	
The Forest of Nisene Marks SP					X				X								
Thornton SB		X			X												
Tolowa Dunes SP																	
Tomales Bay SP																	
Tomo-Kahni SHP																	
Topanga SP																	
Torrey Pines SNR																	
Trinidad SB																	
Tule Elk SNR																	
Turlock Lake SRA																	
Twin Lakes SB									X								
Van Damme SP																	
Verdugo Mountains																	
Ward Creek																	
Washoe Meadows SP																	
Weaverville Joss House SHP																	
Westport-Union Landing SB																	
Wilder Ranch SP					X				X								
Wildwood Canyon																	
Will Rogers SHP																	
William B. Ide Adobe SHP																	
Woodson Bridge SRA																	
Zmudowski SB									X								
Subsection Total	1	2	14	2	17	3	9	3	16	5	5	1	2	1	3	3	2

State Park Unit	Great Valley														Klamath Mountains				
	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins	Eastern Klamath Mountains	Gasquet Mountain Ultramafics	Oregon Mountain	Upper Scott Mountains	Western Jurassic
Pismo SB																			
Plumas-Eureka SP																			
Point Cabrillo Light Station SHP																			
Point Lobos Ranch																			
Point Lobos SNR																			
Point Mugu SP																			
Point Sal SB																			
Point Sur SHP																			
Pomponio SB																			
Portola Redwoods SP																			
Prairie City SVRA		X			X														
Prairie Creek Redwoods SP																			
Providence Mountains SRA																			
Railtown 1897 SHP																			
Red Rock Canyon SP																			
Refugio SB																			
Reynolds WC																			
Richardson Grove SP																			
Rio de Los Angeles State Park SRA																			
Robert H. Meyer Memorial SB																			
Robert Louis Stevenson SP																			
Russian Gulch SP																			
Saddleback Butte SP																			
Salinas River SB																			
Salt Point SP																			
Salton Sea SRA																			
Samuel P. Taylor SP																			
San Buenaventura SB																			
San Clemente SB																			
San Elijo SB																			
San Gregorio SB																			
San Juan Bautista SHP																			
San Luis Reservoir SRA													X						
San Onofre SB																			
San Pasqual Battlefield SHP																			
San Timoteo Canyon																			
Santa Cruz Mission SHP																			
Santa Susana Pass SHP																			
Schooner Gulch SB																			
Seacliff SB																			
Shasta SHP																	X		
Silver Strand SB																			
Silverwood Lake SRA																			
Sinkyone Wilderness SP																			
Smithe Redwoods SNR																			
Sonoma Coast SP																			
Sonoma SHP																			
South Carlsbad SB																			
South Yuba River SP																			
Standish-Hickey SRA																			
State Indian Museum (SHP)														X					
Sugarloaf Ridge SP																			
Sunset SB																			
Sutter Buttes SP	X																		
Sutters Fort SHP														X					
Tahoe SRA																			
The Forest of Nisene Marks SP																			
Thornton SB																			
Tolowa Dunes SP																			
Tomales Bay SP																			
Tomo-Kahni SHP																			
Topanga SP																			
Torrey Pines SNR																			
Trinidad SB																			
Tule Elk SNR											X								
Turlock Lake SRA		X			X														
Twin Lakes SB																			
Van Damme SP																			
Verdugo Mountains																			
Ward Creek																			
Washoe Meadows SP																			
Weaverville Joss House SHP															X				
Westport-Union Landing SB																			
Wilder Ranch SP																			
Wildwood Canyon																			
Will Rogers SHP																			
William B. Ide Adobe SHP							X												
Woodson Bridge SRA							X												
Zmudowski SB																			
Subsection Total	1	2	2	1	6	3	4	2	2	2	2	1	2	6	2	2	1	1	1

State Park Unit	Mojave Desert			Mono		Northern California Coast								Northern California Coast Ranges		Northern California Interior Coast Ranges
	High Desert Plains and Hills	Providence Mountains-Lanfair Valley	Searles Valley-Owlshead Mountains	Bodie Hills-Excelsior Mountains	Mono Valley	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge	Central Franciscan	Clear Lake Hills and Valleys	Tehama Terraces
Pismo SB																
Plumas-Eureka SP																
Point Cabrillo Light Station SHP							X									
Point Lobos Ranch																
Point Lobos SNR																
Point Mugu SP																
Point Sal SB																
Point Sur SHP																
Pomponio SB																
Portola Redwoods SP																
Prairie City SVRA																
Prairie Creek Redwoods SP												X				
Providence Mountains SRA		X														
Railtown 1897 SHP																
Red Rock Canyon SP	X		X													
Refugio SB																
Reynolds WC							X									
Richardson Grove SP							X									
Rio de Los Angeles State Park SRA																
Robert H. Meyer Memorial SB																
Robert Louis Stevenson SP											X					
Russian Gulch SP							X									
Saddleback Butte SP	X															
Salinas River SB																
Salt Point SP							X									
Salton Sea SRA																
Samuel P. Taylor SP										X						
San Buenaventura SB																
San Clemente SB																
San Elijo SB																
San Gregorio SB																
San Juan Bautista SHP																
San Luis Reservoir SRA																
San Onofre SB																
San Pasqual Battlefield SHP																
San Timoteo Canyon																
Santa Cruz Mission SHP																
Santa Susana Pass SHP																
Schooner Gulch SB							X									
Seacliff SB																
Shasta SHP																
Silver Strand SB																
Silverwood Lake SRA	X															
Sinkyone Wilderness SP							X									
Smithe Redwoods SNR							X									
Sonoma Coast SP							X	X								
Sonoma SHP											X					
South Carlsbad SB																
South Yuba River SP																
Standish-Hickey SRA							X									
State Indian Museum (SHP)																
Sugarloaf Ridge SP											X					
Sunset SB																
Sutter Buttes SP																
Sutters Fort SHP																
Tahoe SRA																
The Forest of Nisene Marks SP																
Thornton SB																
Tolowa Dunes SP												X				
Tomales Bay SP										X						
Tomo-Kahni SHP																
Topanga SP																
Torrey Pines SNR																
Trinidad SB									X							
Tule Elk SNR																
Turlock Lake SRA																
Twin Lakes SB																
Van Damme SP							X									
Verdugo Mountains																
Ward Creek																
Washoe Meadows SP																
Weaverville Joss House SHP																
Westport-Union Landing SB							X									
Wilder Ranch SP																
Wildwood Canyon																
Will Rogers SHP																
William B. Ide Adobe SHP																X
Woodson Bridge SRA																
Zmudowski SB																
Subsection Total	6	1	1	1	1	3	32	2	7	6	9	5	1	4	2	1

State Park Unit	Sierra Nevada										Sierra Nevada Foothills			Sonoran Desert
	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt	Lower Foothills Metamorphic Belt	Lower Granitic Foothills	San Emigdio Mountains	Chocolate Mountains and Valleys
Pismo SB														
Plumas-Eureka SP					X				X					
Point Cabrillo Light Station SHP														
Point Lobos Ranch														
Point Lobos SNR														
Point Mugu SP														
Point Sal SB														
Point Sur SHP														
Pomponio SB														
Portola Redwoods SP														
Prairie City SVRA											X			
Prairie Creek Redwoods SP														
Providence Mountains SRA														
Railtown 1897 SHP											X			
Red Rock Canyon SP														
Refugio SB														
Reynolds WC														
Richardson Grove SP														
Rio de Los Angeles State Park SRA														
Robert H. Meyer Memorial SB														
Robert Louis Stevenson SP														
Russian Gulch SP														
Saddleback Butte SP														
Salinas River SB														
Salt Point SP														
Salton Sea SRA														
Samuel P. Taylor SP														
San Buenaventura SB														
San Clemente SB														
San Elijo SB														
San Gregorio SB														
San Juan Bautista SHP														
San Luis Reservoir SRA														
San Onofre SB														
San Pasqual Battlefield SHP														
San Timoteo Canyon														
Santa Cruz Mission SHP														
Santa Susana Pass SHP														
Schooner Gulch SB														
Seacliff SB														
Shasta SHP														
Silver Strand SB														
Silverwood Lake SRA														
Sinkyone Wilderness SP														
Smithe Redwoods SNR														
Sonoma Coast SP														
Sonoma SHP														
South Carlsbad SB														
South Yuba River SP				X						X	X			
Standish-Hickey SRA														
State Indian Museum (SHP)														
Sugarloaf Ridge SP														
Sunset SB														
Sutter Buttes SP														
Sutters Fort SHP														
Tahoe SRA							X							
The Forest of Nisene Marks SP														
Thornton SB														
Tolowa Dunes SP														
Tomales Bay SP														
Tomo-Kahni SHP								X						
Topanga SP														
Torrey Pines SNR														
Trinidad SB														
Tule Elk SNR														
Turlock Lake SRA														
Twin Lakes SB														
Van Damme SP														
Verdugo Mountains														
Ward Creek							X							
Washoe Meadows SP						X								
Weaverville Joss House SHP														
Westport-Union Landing SB														
Wilder Ranch SP														
Wildwood Canyon														
Will Rogers SHP														
William B. Ide Adobe SHP														
Woodson Bridge SRA														
Zmudowski SB														
Subsection Total	1	2	1	3	1	6	5	1	4	6	9	1	1	1

State Park Unit	Southern California Coast								Southern California Mountains and Valleys												Southern Cascades	
	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains	Desert Slopes	Fontana Plain-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Peak	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills	Hat Creek Rim	Medicine Lake Lava Flows
Pismo SB																						
Plumas-Eureka SP																						
Point Cabrillo Light Station SHP																						
Point Lobos Ranch																						
Point Lobos SNR																						
Point Mugu SP					X																	
Point Sal SB						X																
Point Sur SHP																						
Pomponio SB																						
Portola Redwoods SP																						
Prairie City SVRA																						
Prairie Creek Redwoods SP																						
Providence Mountains SRA																						
Railtown 1897 SHP																						
Red Rock Canyon SP																						
Refugio SB							X															
Reynolds WC																						
Richardson Grove SP																						
Rio de Los Angeles State Park SRA			X																			
Robert H. Meyer Memorial SB					X																	
Robert Louis Stevenson SP																						
Russian Gulch SP																						
Saddleback Butte SP																						
Salinas River SB																						
Salt Point SP																						
Salton Sea SRA																						
Samuel P. Taylor SP																						
San Buenaventura SB				X																		
San Clemente SB		X																				
San Elijo SB		X																				
San Gregorio SB																						
San Juan Bautista SHP																						
San Luis Reservoir SRA																						
San Onofre SB	X	X																				
San Pasqual Battlefield SHP																				X		
San Timoteo Canyon										X						X						
Santa Cruz Mission SHP																						
Santa Susana Pass SHP			X					X														
Schooner Gulch SB																						
Seacliff SB																						
Shasta SHP																						
Silver Strand SB		X																				
Silverwood Lake SRA															X				X			
Sinkyone Wilderness SP																						
Smithe Redwoods SNR																						
Sonoma Coast SP																						
Sonoma SHP																						
South Carlsbad SB		X																				
South Yuba River SP																						
Standish-Hickey SRA																						
State Indian Museum (SHP)																						
Sugarloaf Ridge SP																						
Sunset SB																						
Sutter Buttes SP																						
Sutters Fort SHP																						
Tahoe SRA																						
The Forest of Nisene Marks SP																						
Thornton SB																						
Tolowa Dunes SP																						
Tomales Bay SP																						
Tomo-Kahni SHP																						
Topanga SP			X		X			X														
Torrey Pines SNR		X																				
Trinidad SB																						
Tule Elk SNR																						
Turlock Lake SRA																						
Twin Lakes SB																						
Van Damme SP																						
Verdugo Mountains			X																			
Ward Creek																						
Washoe Meadows SP																						
Weaverville Joss House SHP																						
Westport-Union Landing SB																						
Wilder Ranch SP																						
Wildwood Canyon															X							
Will Rogers SHP			X		X																	
William B. Ide Adobe SHP																						
Woodson Bridge SRA																						
Zmudowski SB																						
Subsection Total	3	12	12	3	7	2	6	2	3	2	1	1	3	1	2	2	1	1	1	1	2	1

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
Source: CA State Parks 2010; USFS 1997

Appendix I

Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Table I-1. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Central California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection								
		FESA	CESA	Other DFG	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley
Plants													
adobe sanicle	*Sanicula maritima*	--	CR	1B.1		X	X				X		
adobe-lily	*Fritillaria pluriflora*	--	--	1B.2								X	
alkali milk-vetch	*Astragalus tener var. tener*	--	--	1B.2		X		X				X	X
Anderson's manzanita	*Arctostaphylos andersonii*	--	--	1B.2		X			X				X
Antioch Dunes evening-primrose	*Oenothera deltoides ssp. howellii*	FE	CE	1B.1	X								
arcuate bush-mallow	*Malacothamnus arcuatus*	--	--	1B.2		X		X	X				
Arroyo de la Cruz manzanita	*Arctostaphylos cruzensis*	--	--	1B.2			X				X		
Arroyo de la Cruz mariposa-lily	*Calochortus clavatus var. recurvifolius*	--	--	1B.2							X		
Arroyo Seco bush-mallow	*Malacothamnus palmeri var. lucianus*	--	--	1B.2			X						
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	--	--	1B.1								X	
beach layia	*Layia carnosa*	FE	CE	1B.1		X	X		X				
beach spectaclepod	*Dithyrea maritima*	--	CT	1B.1						X	X		
bearded popcorn-flower	*Plagiobothrys hystriculus*	--	--	1B.1								X	
Ben Lomond buckwheat	*Eriogonum nudum var. decurrens*	--	--	1B.1					X				
Ben Lomond spineflower	*Chorizanthe pungens var. hartwegiana*	FE	--	1B.1					X				
bent-flowered fiddleneck	*Amsinckia lunaris*	--	--	1B.2	X	X			X				
Betty's dudleya	*Dudleya abramsii ssp. bettinae*	--	--	1B.2							X		
big tarplant	*Blepharizonia plumosa*	--	--	1B.1	X							X	
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2	X			X				X	
black-flowered figwort	*Scrophularia atrata*	--	--	1B.2						X	X		
Blasdale's bent grass	*Agrostis blasdalei*	--	--	1B.2					X				
Blochman's dudleya	*Dudleya blochmaniae ssp. blochmaniae*	--	--	1B.1						X	X		
Blochman's leafy daisy	*Erigeron blochmaniae*	--	--	1B.2						X	X		
blue coast gilia	*Gilia capitata ssp. chamissonis*	--	--	1B.1		X							
Bolander's water-hemlock	*Cicuta maculata var. bolanderi*	--	--	2.1								X	
Bonny Doon manzanita	*Arctostaphylos silvicola*	--	--	1B.2					X				
Brandegee's eriastrum	*Eriastrum brandegeeae*	--	--	1B.2	X								
Brewer's spineflower	*Chorizanthe breweri*	--	--	1B.3							X		
Brewer's western flax	*Hesperolinon breweri*	--	--	1B.2	X							X	
bristlecone fir	*Abies bracteata*	--	--	1B.3			X				X		
bristly sedge	*Carex comosa*	--	--	2.1		X			X				
brittlescale	*Atriplex depressa*	--	--	1B.2								X	
Butterworth's buckwheat	*Eriogonum butterworthianum*	--	CR	1B.3			X						
California saw-grass	*Cladium californicum*	--	--	2.2						X			
California screw moss	*Tortula californica*	--	--	1B.2			X						
California seablite	*Suaeda californica*	FE	--	1B.1		X					X		
caper-fruited tropidocarpum	*Tropidocarpum capparideum*	--	--	1B.1	X							X	
Carmel Valley bush-mallow	*Malacothamnus palmeri var. involucratus*	--	--	1B.2			X				X		
Carmel Valley malacothrix	*Malacothrix saxatilis var. arachnoidea*	--	--	1B.2			X						
Carquinez goldenbush	*Isocoma arguta*	--	--	1B.1	X							X	
chaparral harebell	*Campanula exigua*	--	--	1B.2	X								
chaparral ragwort	*Senecio aphanactis*	--	--	2.2							X	X	
Choris' popcorn-flower	*Plagiobothrys chorisianus var. chorisianus*	--	--	1B.2		X			X				X
Chorro Creek bog thistle	*Cirsium fontinale var. obispoense*	FE	CE	1B.2							X		
coast yellow leptosiphon	*Leptosiphon croceus*	--	--	1B.1					X				
coastal bluff morning-glory**	*Calystegia purpurata ssp. saxicola*	--	--	1B.2	X								
coastal dunes milk-vetch	*Astragalus tener var. titi*	FE	CE	1B.1			X						
coastal goosefoot	*Chenopodium littoreum*	--	--	1B.2						X	X		
coastal marsh milk-vetch	*Astragalus pycnostachyus var. pycnostachyus*	--	--	1B.2		X			X				
coastal triquetrella	*Triquetrella californica*	--	--	1B.2	X	X			X				
compact cobwebby thistle	*Cirsium occidentale var. compactum*	--	--	1B.2		X	X				X		
Cone Peak bedstraw	*Galium californicum ssp. luciense*	--	--	1B.3			X				X		
Congdon's tarplant	*Centromadia parryi ssp. congdonii*	--	--	1B.2	X		X	X			X	X	X
Contra Costa goldfields	*Lasthenia conjugens*	FE	--	1B.1	X			X				X	X
Contra Costa manzanita	*Arctostaphylos manzanita ssp. laevigata*	--	--	1B.2	X							X	
Cook's triteleia	*Triteleia ixioides ssp. cookii*	--	--	1B.3			X				X		
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	--	--	1B.1							X		
Coulter's saltbush	*Atriplex coulteri*	--	--	1B.2							X		
Coyote ceanothus	*Ceanothus ferrisiae*	FE	--	1B.1		X		X					
crisp monardella	*Monardella crispa*	--	--	1B.2						X	X		
Crystal Springs lessingia	*Lessingia arachnoidea*	--	--	1B.2		X			X				
Cuesta Pass checkerbloom	*Sidalcea hickmanii ssp. anomala*	--	CR	1B.2							X		
Cuesta Ridge thistle	*Cirsium occidentale var. lucianum*	--	--	1B.2							X		
dacite manzanita	*Arctostaphylos tomentosa ssp. daciticola*	--	--	1B.1							X		
dark-eyed gilia	*Gilia millefoliata*	--	--	1B.2		X							
Davidson's bush-mallow	*Malacothamnus davidsonii*	--	--	1B.2		X		X	X				
Davidson's saltscale	*Atriplex serenana var. davidsonii*	--	--	1B.2						X			
deceiving sedge	*Carex saliniformis*	--	--	1B.2					X				
Delta tule pea	*Lathyrus jepsonii var. jepsonii*	--	--	1B.2								X	
Diablo Canyon blue grass	*Poa diaboli*	--	--	1B.2							X		
Diablo helianthella	*Helianthella castanea*	--	--	1B.2	X	X						X	
diamond-petaled California poppy	*Eschscholzia rhombipetala*	--	--	1B.1								X	
Dudley's lousewort	*Pedicularis dudleyi*	--	CR	1B.2			X		X		X		X
dune larkspur	*Delphinium parryi ssp. blochmaniae*	--	--	1B.2						X	X		
dwarf calycadenia	*Calycadenia villosa*	--	--	1B.1			X				X		
dwarf downingia	*Downingia pusilla*	--	--	2.2								X	
dwarf goldenstar	*Bloomeria humilis*	--	CR	1B.2							X		
dwarf soaproot	*Chlorogalum pomeridianum var. minus*	--	--	1B.2							X		
Eastwood's goldenbush	*Ericameria fasciculata*	--	--	1B.1			X						X
elongate copper moss	*Mielichhoferia elongata*	--	--	2.2					X				
fountain thistle	*Cirsium fontinale var. fontinale*	FE	CE	1B.1		X			X				
fragrant fritillary	*Fritillaria liliacea*	--	--	1B.2	X	X	X	X	X			X	X
Franciscan manzanita	*Arctostaphylos franciscana*	--	--	1B.1		X							
Franciscan onion	*Allium peninsulare var. franciscanum*	--	--	1B.2		X		X	X				
Franciscan thistle	*Cirsium andrewsii*	--	--	1B.2	X	X			X				
Gambel's water cress	*Nasturtium gambelii*	FE	CT	1B.1						X			
Gaviota tarplant	*Deinandra increscens ssp. villosa*	FE	CE	1B.1						X			
Gowen cypress	*Hesperocyparis goveniana*	FT	--	1B.2			X						
Hall's bush-mallow	*Malacothamnus hallii*	--	--	1B.2	X	X		X	X			X	
Hardham's bedstraw	*Galium hardhamiae*	--	--	1B.3			X				X		
Hardham's evening-primrose	*Camissonia hardhamiae*	--	--	1B.2							X		
Hearst's ceanothus	*Ceanothus hearstiorum*	--	CR	1B.2							X		
Hearst's manzanita	*Arctostaphylos hookeri ssp. hearstiorum*	--	CE	1B.2							X		
heartscale	*Atriplex cordulata*	--	--	1B.2								X	
Hickman's checkerbloom	*Sidalcea hickmanii ssp. hickmanii*	--	--	1B.3			X				X		
Hickman's cinquefoil	*Potentilla hickmanii*	FE	CE	1B.1			X		X				X
Hickman's onion	*Allium hickmanii*	--	--	1B.2			X				X		X
Hillsborough chocolate lily	*Fritillaria biflora var. ineziana*	--	--	1B.1		X			X				
hooked popcorn-flower	*Plagiobothrys uncinatus*	--	--	1B.2			X				X		
Hooker's manzanita	*Arctostaphylos hookeri ssp. hookeri*	--	--	1B.2			X						X
Hoover's bent grass	*Agrostis hooveri*	--	--	1B.2						X	X		
Hoover's button-celery	*Eryngium aristulatum var. hooveri*	--	--	1B.1		X		X			X		
Hospital Canyon larkspur	*Delphinium californicum ssp. interius*	--	--	1B.2	X		X						
Hutchinson's larkspur	*Delphinium hutchinsoniae*	--	--	1B.2			X						X
Indian Knob mountainbalm	*Eriodictyon altissimum*	FE	CE	1B.1							X		
Indian Valley bush-mallow	*Malacothamnus aboriginum*	--	--	1B.2		X		X	X				X
Jolon clarkia	*Clarkia jolonensis*	--	--	1B.2			X						X
Jones' layia	*Layia jonesii*	--	--	1B.2							X		
Kellman's bristle moss	*Orthotrichum kellmanii*	--	--	1B.2			X		X				
Kellogg's horkelia	*Horkelia cuneata ssp. sericea*	--	--	1B.1		X	X		X	X	X		X

Table I-1. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Central California Coast Section

Common Name	Scientific Name	Status[1] FESA	Status[1] CESA	Status[1] Other DFG	USFS Ecological Subsection: East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley
Kings Mountain manzanita	*Arctostaphylos regismontana*	--	--	1B.2		X			X				
La Graciosa thistle	*Cirsium scariosum var. loncholepis*	FE	CT	1B.1						X			
La Panza mariposa-lily	*Calochortus obispoensis*	--	--	1B.2							X		
large-flowered fiddleneck	*Amsinckia grandiflora*	FE	CE	1B.1	X							X	
late-flowered mariposa-lily	*Calochortus fimbriatus*	--	--	1B.2			X				X		
leafy tarplant	*Deinandra increscens ssp. foliosa*	--	--	1B.2						X	X		
legenere	*Legenere limosa*	--	--	1B.1					X			X	X
Lime Ridge navarretia	*Navarretia gowenii*	--	--	1B.1	X								
Little Sur manzanita	*Arctostaphylos edmundsii*	--	--	1B.2			X						
Loma Prieta hoita	*Hoita strobilina*	--	--	1B.1	X	X		X	X				X
Marin western flax	*Hesperolinon congestum*	FT	CT	1B.1		X			X				
maritime ceanothus	*Ceanothus maritimus*	--	CR	1B.2							X		
marsh microseris	*Microseris paludosa*	--	--	1B.2		X	X		X		X		X
marsh sandwort	*Arenaria paludicola*	FE	CE	1B.1		X			X	X	X		
Mason's lilaeopsis	*Lilaeopsis masonii*	--	CR	1B.1								X	
Menzies' wallflower	*Erysimum menziesii ssp. menziesii*	FE	CE	1B.1			X						
mesa horkelia	*Horkelia cuneata ssp. puberula*	--	--	1B.1						X	X		
Metcalf Canyon jewel-flower	*Streptanthus albidus ssp. albidus*	FE	--	1B.1		X		X	X				
Miles' milk-vetch	*Astragalus didymocarpus var. milesianus*	--	--	1B.2						X	X		
minute pocket moss	*Fissidens pauperculus*	--	--	1B.2					X				
Montara manzanita	*Arctostaphylos montaraensis*	--	--	1B.2		X			X				
Monterey clover	*Trifolium trichocalyx*	FE	CE	1B.1			X						
Monterey cypress	*Hesperocyparis macrocarpa*	--	--	1B.2			X						
Monterey pine	*Pinus radiata*	--	--	1B.1			X		X		X		X
Monterey spineflower	*Chorizanthe pungens var. pungens*	FT	--	1B.2			X				X		X
Morro manzanita	*Arctostaphylos morroensis*	FT	--	1B.1							X		
most beautiful jewel-flower	*Streptanthus albidus ssp. peramoenus*	--	--	1B.2	X	X	X	X			X		
mouse-gray dudleya	*Dudleya abramsii ssp. murina*	--	--	1B.3							X		
Mt. Diablo bird's-beak	*Cordylanthus nidularius*	--	CR	1B.1	X								
Mt. Diablo buckwheat	*Eriogonum truncatum*	--	--	1B.1	X							X	
Mt. Diablo fairy-lantern	*Calochortus pulchellus*	--	--	1B.2	X							X	
Mt. Diablo jewel-flower	*Streptanthus hispidus*	--	--	1B.3	X								
Mt. Diablo manzanita	*Arctostaphylos auriculata*	--	--	1B.3	X							X	
Mt. Diablo phacelia	*Phacelia phacelioides*	--	--	1B.2	X								
Mt. Hamilton fountain thistle	*Cirsium fontinale var. campylon*	--	--	1B.2		X		X					
Muir's tarplant	*Carlquistia muirii*	--	--	1B.3			X						
Napa false indigo	*Amorpha californica var. napensis*	--	--	1B.2			X						
Nipomo Mesa lupine	*Lupinus nipomensis*	FE	CE	1B.1						X			
Norris' beard moss	*Didymodon norrisii*	--	--	2.2	X		X		X				
Northern California black walnut	*Juglans hindsii*	--	--	1B.1	X								
Ohlone manzanita	*Arctostaphylos ohloneana*	--	--	1B.1					X				
Oregon meconella	*Meconella oregana*	--	--	1B.1	X								
Oregon polemonium	*Polemonium carneum*	--	--	2.2	X				X				
Oso manzanita	*Arctostaphylos osoensis*	--	--	1B.2							X		
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2.3	X								
Pacific Grove clover	*Trifolium polyodon*	--	CR	1B.1			X						X
Pacific manzanita	*Arctostaphylos pacifica*	--	CE	1B.2		X							
Pajaro manzanita	*Arctostaphylos pajaroensis*	--	--	1B.1					X				X
pale-yellow layia	*Layia heterotricha*	--	--	1B.1			X						X
pallid manzanita	*Arctostaphylos pallida*	FT	CE	1B.1	X								
Palmer's monardella	*Monardella palmeri*	--	--	1B.2			X				X		
pappose tarplant	*Centromadia parryi ssp. parryi*	--	--	1B.2					X		X	X	
Pecho manzanita	*Arctostaphylos pechoensis*	--	--	1B.2							X		
perennial goldfields	*Lasthenia californica ssp. macrantha*	--	--	1B.2					X		X		
pine rose	*Rosa pinetorum*	--	--	1B.2			X		X				X
pink creamsacs	*Castilleja rubicundula ssp. rubicundula*	--	--	1B.2		X						X	
pink johnny-nip	*Castilleja ambigua ssp. insalutata*	--	--	1B.1			X				X		X
Pinnacles buckwheat	*Eriogonum nortonii*	--	--	1B.3			X						X
Pismo clarkia	*Clarkia speciosa ssp. immaculata*	FE	CR	1B.1						X	X		
Point Reyes bird's-beak	*Chloropyron maritimum ssp. palustre*	--	--	1B.2		X		X					
Point Reyes horkelia	*Horkelia marinensis*	--	--	1B.2		X			X				
Point Reyes meadowfoam	*Limnanthes douglasii ssp. sulphurea*	--	CE	1B.2					X				
Presidio clarkia	*Clarkia franciscana*	FE	CE	1B.1	X	X							
Presidio manzanita	*Arctostaphylos montana ssp. ravenii*	FE	CE	1B.1		X							
prostrate vernal pool navarretia	*Navarretia prostrata*	--	--	1B.1				X					
recurved larkspur	*Delphinium recurvatum*	--	--	1B.2								X	
robust spineflower	*Chorizanthe robusta var. robusta*	FE	--	1B.1		X		X	X				X
rock sanicle	*Sanicula saxatilis*	--	CR	1B.2	X								
rose leptosiphon	*Leptosiphon rosaceus*	--	--	1B.1		X			X				
rose leptosiphon**	*Leptosiphon rosaceus*	--	--	1B.1					X				
round-headed Chinese-houses	*Collinsia corymbosa*	--	--	1B.2		X							
round-leaved filaree	*California macrophylla*	--	--	1B.1	X		X	X	X			X	
saline clover	*Trifolium hydrophilum*	--	--	1B.2			X	X	X		X	X	X
salt marsh bird's-beak	*Chloropyron maritimum ssp. maritimum*	FE	CE	1B.2							X		
San Benito fritillary	*Fritillaria viridea*	--	--	1B.2			X				X		
San Benito pentachaeta	*Pentachaeta exilis ssp. aeolica*	--	--	1B.2			X						
San Bernardino aster	*Symphyotrichum defoliatum*	--	--	1B.2						X			
San Bruno Mountain manzanita	*Arctostaphylos imbricata*	--	CE	1B.1		X							
San Francisco Bay spineflower	*Chorizanthe cuspidata var. cuspidata*	--	--	1B.2		X			X				
San Francisco campion	*Silene verecunda ssp. verecunda*	--	--	1B.2		X			X				
San Francisco collinsia	*Collinsia multicolor*	--	--	1B.2		X	X	X	X				
San Francisco lessingia	*Lessingia germanorum*	FE	CE	1B.1		X							
San Francisco owl's-clover	*Triphysaria floribunda*	--	--	1B.2		X		X	X				
San Francisco popcorn-flower	*Plagiobothrys diffusus*	--	CE	1B.1	X	X			X				X
San Joaquin spearscale	*Atriplex joaquiniana*	--	--	1B.2	X			X			X	X	
San Luis Obispo County lupine	*Lupinus ludovicianus*	--	--	1B.2							X		
San Luis Obispo mariposa-lily	*Calochortus simulans*	--	--	1B.3							X		
San Luis Obispo monardella	*Monardella frutescens*	--	--	1B.2						X	X		
San Luis Obispo owl's-clover	*Castilleja densiflora ssp. obispoensis*	--	--	1B.2							X		
San Luis Obispo sedge	*Carex obispoensis*	--	--	1B.2			X				X		
San Mateo thorn-mint	*Acanthomintha duttonii*	FE	CE	1B.1		X		X	X				
San Mateo woolly sunflower	*Eriophyllum latilobum*	FE	CE	1B.1		X			X				
San Simeon baccharis	*Baccharis plummerae ssp. glabrata*	--	--	1B.2							X		
sand gilia	*Gilia tenuiflora ssp. arenaria*	FE	CT	1B.2			X						X
sand mesa manzanita	*Arctostaphylos rudis*	--	--	1B.2						X			
sand-loving wallflower	*Erysimum ammophilum*	--	--	1B.2					X				X
sandmat manzanita	*Arctostaphylos pumila*	--	--	1B.2			X						X
Santa Clara Valley dudleya	*Dudleya abramsii ssp. setchellii*	FE	--	1B.1		X		X					
Santa Cruz clover	*Trifolium buckwestiorum*	--	--	1B.1			X		X				X
Santa Cruz cypress	*Hesperocyparis abramsiana var. abramsiana*	FE	CE	1B.2					X				
Santa Cruz microseris	*Stebbinsoseris decipiens*	--	--	1B.2			X		X				X
Santa Cruz Mountains beardtongue	*Penstemon rattanii var. kleei*	--	--	1B.2		X			X				
Santa Cruz Mountains pussypaws	*Calyptridium parryi var. hesseae*	--	--	1B.1		X	X		X		X		
Santa Cruz tarplant	*Holocarpha macradenia*	FT	CE	1B.1	X				X				X
Santa Cruz wallflower	*Erysimum teretifolium*	FE	CE	1B.1					X				
Santa Lucia bedstraw	*Galium clementis*	--	--	1B.3			X				X		
Santa Lucia bush-mallow	*Malacothamnus palmeri var. palmeri*	--	--	1B.2			X				X		
Santa Lucia dwarf rush	*Juncus luciensis*	--	--	1B.2			X						
Santa Lucia manzanita	*Arctostaphylos luciana*	--	--	1B.2							X		
Santa Lucia mint	*Pogogyne clareana*	--	CE	1B.2			X				X		
Santa Margarita manzanita	*Arctostaphylos pilosula*	--	--	1B.2							X		
Schreiber's manzanita	*Arctostaphylos glutinosa*	--	--	1B.2					X				

Table I-1. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Central California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection								
		FESA	CESA	Other DFG	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley
Scotts Valley polygonum	*Polygonum hickmanii*	FE	CE	1B.1					X				
Scotts Valley spineflower	*Chorizanthe robusta var. hartwegii*	FE	--	1B.1					X				
seaside bird's-beak	*Cordylanthus rigidus ssp. littoralis*	--	CE	1B.1			X						X
seaside tarplant	*Hemizonia congesta ssp. congesta*	--	--	1B.2		X			X				
shining navarretia	*Navarretia nigelliformis ssp. radians*	--	--	1B.2	X								
short-leaved evax	*Hesperevax sparsiflora var. brevifolia*	--	--	1B.2		X			X				
showy golden madia	*Madia radiata*	--	--	1B.1								X	
showy rancheria clover	*Trifolium amoenum*	FE	--	1B.1		X			X			X	
slender silver moss	*Anomobryum julaceum*	--	--	2.2	X				X			X	
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2	X			X	X			X	
small-flowered calycadenia	*Calycadenia micrantha*	--	--	1B.2			X						
smooth lessingia	*Lessingia micradenia var. glabrata*	--	--	1B.2		X		X	X				
soft bird's-beak	*Chloropyron molle ssp. molle*	FE	CR	1B.2	X**							X	
straight-awned spineflower	*Chorizanthe rectispina*	--	--	1B.3							X		
Suisun Marsh aster	*Symphyotrichum lentum*	--	--	1B.2								X	
Suisun thistle	*Cirsium hydrophilum var. hydrophilum*	FE	--	1B.1								X	
surf thistle	*Cirsium rhothophilum*	--	CT	1B.2						X	X		
swamp harebell	*Campanula californica*	--	--	1B.2					X				
talus fritillary	*Fritillaria falcata*	--	--	1B.2			X						
tear drop moss	*Dacryophyllum falcifolium*	--	--	1B.3			X		X				
Tiburon buckwheat	*Eriogonum luteolum var. caninum*	--	--	1B.2	X								
Tiburon paintbrush	*Castilleja affinis ssp. neglecta*	FE	CT	1B.2								X	
Tidestrom's lupine	*Lupinus tidestromii*	FE	CE	1B.1			X						
Tidestrom's lupine**	*Lupinus tidestromii*	FE	CE	1B.1			X						
Toro manzanita	*Arctostaphylos montereyensis*	--	--	1B.2			X				X		X
umbrella larkspur	*Delphinium umbraculorum*	--	--	1B.3			X				X		
vernal pool smallscale	*Atriplex persistens*	--	--	1B.2								X	
Wells' manzanita	*Arctostaphylos wellsii*	--	--	1B.1						X	X		
western leatherwood	*Dirca occidentalis*	--	--	1B.2	X	X		X	X			X	
white-flowered rein orchid	*Piperia candida*	--	--	1B.2					X				
white-rayed pentachaeta	*Pentachaeta bellidiflora*	FE	CE	1B.1		X			X				X
woodland woollythreads	*Monolopia gracilens*	--	--	1B.2	X	X	X	X	X		X		X
Yadon's rein orchid	*Piperia yadonii*	FE	--	1B.1			X						X
Yadon's wallflower	*Erysimum menziesii ssp. yadonii*	FE	CE	1B.1									X
yellow-flowered eriastrum	*Eriastrum luteum*	--	--	1B.2			X				X		
Wildlife													
Alameda Island mole**	*Scapanus latimanus parvus*	--	--	CSC	X	X							
Alameda song sparrow	*Melospiza melodia pusillula*	--	--	CSC	X	X		X					
Alameda whipsnake	*Masticophis lateralis euryxanthus*	FT	CT	--	X			X				X	
American badger	*Taxidea taxus*	--	--	CSC	X	X	X	X	X	X	X	X	X
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP	X	X		X	X			X	X
arroyo chub	*Gila orcuttii*	--	--	CSC						X	X		
arroyo toad	*Anaxyrus californicus*	FE	--	CSC						X			
ashy storm-petrel**	*Oceanodroma homochroa*	--	--	CSC		X	X		X				
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X								
bank swallow	*Riparia riparia*	--	CT	--		X		X	X				X
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT	--	--	X	X	X	X	X				
big free-tailed bat	*Nyctinomops macrotis*	--	--	CSC	X				X		X	X	
black legless lizard	*Anniella pulchra nigra*	--	--	CSC			X				X		X
black swift	*Cypseloides niger*	--	--	CSC		X	X		X		X		X
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X		X	X	X	X	X	X
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP	X	X		X	X	X	X	X	
California brown pelican	*Pelecanus occidentalis californicus*	FD	CD	FP			X						
California clapper rail	*Rallus longirostris obsoletus*	FE	CE	FP	X	X		X			X	X	X
California condor	*Gymnogyps californianus*	FE	CE	--									X
California least tern	*Sternula antillarum browni*	FE	CE	FP				X		X		X	
California red-legged frog	*Rana draytonii*	FT	--	CSC	X	X	X	X	X	X	X	X	X
California spotted owl	*Strix occidentalis occidentalis*	--	--	CSC			X				X		
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC	X	X	X	X	X	X		X	X
callippe silverspot butterfly	*Speyeria callippe callippe*	FE	--	--		X							
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X	X	X			X	X		X
Coast Range newt	*Taricha torosa*	--	--	CSC			X				X		X
coho salmon - central California coast ESU	*Oncorhynchus kisutch*	FE	CE	--					X				X
Conservancy fairy shrimp	*Branchinecta conservatio*	FE	--	--								X	
Delta smelt**	*Hypomesus transpacificus*	FT	CE	--	X							X	
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	X	X		X		X	X	X
golden eagle	*Aquila chrysaetos*	--	--	FP	X	X		X				X	X
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC							X		
Guadalupe fur-seal**	*Arctocephalus townsendi*	FT	CT	FP		X			X				
hardhead	*Mylopharodon conocephalus*	--	--	CSC		X							
least Bell's vireo	*Vireo bellii pusillus*	FE	CE	--				X		X			
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC							X		
long-eared owl	*Asio otus*	--	--	CSC					X				
marbled murrelet*	*Brachyramphus marmoratus*	FT	CE	--		X	X		X	X	X		X
Mission blue butterfly	*Plebejus icarioides missionensis*	FE	--	--		X			X				
Monterey dusky-footed woodrat	*Neotoma macrotis luciana*	--	--	CSC			X						
Morro Bay kangaroo rat	*Dipodomys heermanni morroensis*	FE	CE	FP							X		
Morro shoulderband (=banded dune) snail	*Helminthoglypta walkeriana*	FE	--	--							X		
Mount Hermon (=barbate) June beetle	*Polyphylla barbata*	FE	--	--					X				
Myrtle's silverspot	*Speyeria zerene myrtleae*	FE	--	--		X		X	X				
northern harrier	*Circus cyaneus*	--	--	CSC								X	
Ohlone tiger beetle	*Cicindela ohlone*	FE	--	--					X				
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	X	X	X	X	X		X
purple martin	*Progne subis*	--	--	CSC			X						
Sacramento perch	*Archoplites interruptus*	--	--	CSC	X								
Sacramento splittail	*Pogonichthys macrolepidotus*	--	--	CSC								X	
Salinas pocket mouse	*Perognathus inornatus psammophilus*	--	--	CSC									X
saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	--	--	CSC		X			X			X	
salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE	CE	FP	X			X				X	
salt-marsh wandering shrew	*Sorex vagrans halicoetes*	--	--	CSC	X			X					
San Bruno elfin butterfly	*Callophrys mossii bayensis*	FE	--	--	X	X			X				
San Diego desert woodrat	*Neotoma lepida intermedia*	--	--	CSC							X		
San Francisco dusky-footed woodrat	*Neotoma fuscipes annectens*	--	--	CSC	X	X			X				
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE	CE	FP		X		X	X				
San Joaquin kit fox	*Vulpes macrotis mutica*	FE	CT	--	X			X				X	X
San Joaquin whipsnake	*Masticophis flagellum ruddocki*	--	--	CSC				X					X
San Pablo song sparrow	*Melospiza melodia samuelis*	--	--	CSC	X							X	
San Pablo vole	*Microtus californicus sanpabloensis*	--	--	CSC	X								
Santa Cruz long-toed salamander	*Ambystoma macrodactylum croceum*	FE	CE	FP									X
short-eared owl	*Asio flammeus*	--	--	CSC									X
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC						X	X	X	X
Smith's blue butterfly	*Euphilotes enoptes smithi*	FE	--	--			X		X		X		X
southern steelhead - southern California DPS	*Oncorhynchus mykiss irideus*	FE	--	CSC						X	X		
steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	FT	--	--	X				X			X	X
steelhead - south/central California coast DPS	*Oncorhynchus mykiss irideus*	FT	--	CSC		X	X	X	X	X	X		X
Steller (=northern) sea-lion**	*Eumetopias jubatus*	FT	--	--		X			X				
Suisun shrew	*Sorex ornatus sinuosus*	--	--	CSC								X	
Suisun song sparrow	*Melospiza melodia maxillaris*	--	--	CSC								X	
Swainson's hawk	*Buteo swainsoni*	--	CT	--								X	
tidewater goby	*Eucyclogobius newberryi*	FE	--	CSC		X			X	X	X		X
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC					X		X		

Table I-1. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Central California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection								
		FESA	CESA	Other DFG	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X	X	X	X	X	X	X	X
tufted puffin	*Fratercula cirrhata*	--	--	CSC			X				X**		
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC			X			X	X		
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	--	--								X	
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	--	--							X	X	
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	--	--								X	
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X		X	X			X		X
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X	X	X	X	X	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC		X	X	X				X	
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC			X	X	X	X	X		X
western spadefoot	*Spea hammondii*	--	--	CSC				X		X			X
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--							X		
white-tailed kite	*Elanus leucurus*	--	--	FP	X**	X		X	X		X	X	X
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC	X					X			
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	--	--	CSC	X								
Zayante band-winged grasshopper	*Trimerotropis infantilis*	FE	--	--		X			X				X
Natural Communities													
Alkali Seep	*Alkali Seep*	--	--	--							X		
Central Dune Scrub	*Central Dune Scrub*	--	--	--			X			X	X		X
Central Foredunes	*Central Foredunes*	--	--	--						X			
Central Maritime Chaparral	*Central Maritime Chaparral*	--	--	--			X			X	X		X
Coastal and Valley Freshwater Marsh	*Coastal and Valley Freshwater Marsh*	--	--	--						X	X		X
Coastal Brackish Marsh	*Coastal Brackish Marsh*	--	--	--					X		X	X	X
Maritime Coast Range Ponderosa Pine Forest	*Maritime Coast Range Ponderosa Pine Forest*	--	--	--					X				
Monterey Cypress Forest	*Monterey Cypress Forest*	--	--	--			X						
Monterey Pine Forest	*Monterey Pine Forest*	--	--	--			X		X		X		X
Monterey Pygmy Cypress Forest	*Monterey Pygmy Cypress Forest*	--	--	--			X						
N. Central Coast Calif. Roach/Stickleback/Steelhead Stream	*N. Central Coast Calif. Roach/Stickleback/Steelhead Stream*	--	--	--					X				
North Central Coast Drainage Sacramento Sucker/Roach River	*North Central Coast Drainage Sacramento Sucker/Roach River*	--	--	--				X	X				X
North Central Coast Fall-Run Steelhead Stream	*North Central Coast Fall-Run Steelhead Stream*	--	--	--			X						
North Central Coast Short-Run Coho Stream	*North Central Coast Short-Run Coho Stream*	--	--	--					X				
North Central Coast Steelhead/Sculpin Stream	*North Central Coast Steelhead/Sculpin Stream*	--	--	--					X				
Northern Bishop Pine Forest	*Northern Bishop Pine Forest*	--	--	--			X						
Northern Claypan Vernal Pool	*Northern Claypan Vernal Pool*	--	--	--								X	
Northern Coastal Salt Marsh	*Northern Coastal Salt Marsh*	--	--	--	X			X	X		X	X	X
Northern Interior Cypress Forest	*Northern Interior Cypress Forest*	--	--	--					X		X		
Northern Maritime Chaparral	*Northern Maritime Chaparral*	--	--	--	X				X				
Sacramento-San Joaquin Coastal Lagoon	*Sacramento-San Joaquin Coastal Lagoon*	--	--	--					X				
Serpentine Bunchgrass	*Serpentine Bunchgrass*	--	--	--	X	X		X	X		X	X	
Southern Vernal Pool	*Southern Vernal Pool*	--	--	--						X			
Sycamore Alluvial Woodland	*Sycamore Alluvial Woodland*	--	--	--			X	X					
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--	X		X		X	X	X		X
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--			X	X			X		

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest Ecological Subsection
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-2. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Central California Coast Ranges Section

Common Name	Scientific Name	Status[1] FESA	Status[1] CESA	Status[1] Other DFG	USFS Ecological Subsection: Diablo Range	Eastern Hills	Fremont-Livermore Hills and Valleys	Gabilan Range	Western Diablo Range
Plants									
alkali milk-vetch	*Astragalus tener var. tener*	--	--	1B.2		X	X		
Arburua Ranch jewel-flower	*Streptanthus insignis ssp. lyonii*	--	--	1B.2	X	X			
arcuate bush-mallow	*Malacothamnus arcuatus*	--	--	1B.2	X		X		X
bent-flowered fiddleneck	*Amsinckia lunaris*	--	--	1B.2		X			X
big tarplant	*Blepharizonia plumosa*	--	--	1B.1	X	X			
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2			X		X
Brandegee's eriastrum	*Eriastrum brandegeeae*	--	--	1B.2	X				
Brewer's western flax	*Hesperolinon breweri*	--	--	1B.2		X			
brittlescale	*Atriplex depressa*	--	--	1B.2		X	X		
California jewel-flower	*Caulanthus californicus*	FE	CE	1B.1		X			
caper-fruited tropidocarpum	*Tropidocarpum capparideum*	--	--	1B.1		X	X		
Carmel Valley malacothrix	*Malacothrix saxatilis var. arachnoidea*	--	--	1B.2	X				
chaparral harebell	*Campanula exigua*	--	--	1B.2	X		X		X
chaparral ragwort	*Senecio aphanactis*	--	--	2.2		X			
Congdon's tarplant	*Centromadia parryi ssp. congdonii*	--	--	1B.2		X	X	X	
Coyote ceanothus	*Ceanothus ferrisiae*	FE	--	1B.1			X		
delicate bluecup	*Githopsis tenella*	--	--	1B.3	X			X	
Diablo helianthella	*Helianthella castanea*	--	--	1B.2	X	X	X		
diamond-petaled California poppy	*Eschscholzia rhombipetala*	--	--	1B.1		X			
Eastwood's buckwheat	*Eriogonum eastwoodianum*	--	--	1B.3	X				
fragrant fritillary	*Fritillaria liliacea*	--	--	1B.2			X		
Gabilan Mountains manzanita	*Arctostaphylos gabilanensis*	--	--	1B.2				X	
Hall's bush-mallow	*Malacothamnus hallii*	--	--	1B.2	X		X		X
Hall's tarplant	*Deinandra halliana*	--	--	1B.1	X	X		X	
Hardham's evening-primrose	*Camissonia hardhamiae*	--	--	1B.2				X	
heartscale	*Atriplex cordulata*	--	--	1B.2		X	X		
Hernandez spineflower	*Chorizanthe biloba var. immemora*	--	--	1B.2	X	X		X	
hispid bird's-beak	*Chloropyron molle ssp. hispidum*	--	--	1B.1			X		
hooked popcorn-flower	*Plagiobothrys uncinatus*	--	--	1B.2	X			X	
Hoover's button-celery	*Eryngium aristulatum var. hooveri*	--	--	1B.1					X
Hospital Canyon larkspur	*Delphinium californicum ssp. interius*	--	--	1B.2	X	X	X		X
Indian Valley bush-mallow	*Malacothamnus aboriginum*	--	--	1B.2	X	X		X	
Jared's pepper-grass	*Lepidium jaredii ssp. jaredii*	--	--	1B.2		X			
Jolon clarkia	*Clarkia jolonensis*	--	--	1B.2				X	
large-flowered fiddleneck	*Amsinckia grandiflora*	FE	CE	1B.1	X	X			
legenere	*Legenere limosa*	--	--	1B.1					X
Lemmon's jewel-flower	*Caulanthus lemmonii*	--	--	1B.2	X	X		X	
lesser saltscale	*Atriplex minuscula*	--	--	1B.1		X	X		
Lime Ridge navarretia	*Navarretia gowenii*	--	--	1B.1	X				
Livermore tarplant	*Deinandra bacigalupii*	--	--	1B.2		X	X		
Loma Prieta hoita	*Hoita strobilina*	--	--	1B.1	X		X		
Lost Hills crownscale	*Atriplex coronata var. vallicola*	--	--	1B.2		X			
marsh microseris	*Microseris paludosa*	--	--	1B.2					X
Mason's neststraw	*Stylocline masonii*	--	--	1B.1		X			
Metcalf Canyon jewel-flower	*Streptanthus albidus ssp. albidus*	FE	--	1B.1			X		X
most beautiful jewel-flower	*Streptanthus albidus ssp. peramoenus*	--	--	1B.2			X		X
Mount Day rockcress	*Boechera rubicundula*	--	--	1B.1					X
Mt. Diablo buckwheat	*Eriogonum truncatum*	--	--	1B.1		X	X		
Mt. Diablo fairy-lantern	*Calochortus pulchellus*	--	--	1B.2		X			
Mt. Diablo manzanita	*Arctostaphylos auriculata*	--	--	1B.3		X			
Mt. Diablo phacelia	*Phacelia phacelioides*	--	--	1B.2	X				X
Mt. Hamilton coreopsis	*Leptosyne hamiltonii*	--	--	1B.2	X				X
Mt. Hamilton fountain thistle	*Cirsium fontinale var. campylon*	--	--	1B.2	X		X		
Mt. Hamilton jewel-flower	*Streptanthus callistus*	--	--	1B.3	X				X
Mt. Hamilton lomatium	*Lomatium observatorium*	--	--	1B.2	X				X
Munz's tidy-tips	*Layia munzii*	--	--	1B.2	X	X			
Napa western flax	*Hesperolinon sp. nov. "serpentinum"*	--	--	1B.1	X				
Norris' beard moss	*Didymodon norrisii*	--	--	2.2				X	
Oregon meconella	*Meconella oregana*	--	--	1B.1	X				
Pajaro manzanita	*Arctostaphylos pajaroensis*	--	--	1B.1				X	
pale-yellow layia	*Layia heterotricha*	--	--	1B.1	X	X		X	
palmate-bracted bird's-beak	*Chloropyron palmatum*	FE	CE	1B.1			X		
Panoche pepper-grass	*Lepidium jaredii ssp. album*	--	--	1B.2	X	X			
Pinnacles buckwheat	*Eriogonum nortonii*	--	--	1B.3	X			X	
prostrate vernal pool navarretia	*Navarretia prostrata*	--	--	1B.1	X		X		
rayless layia	*Layia discoidea*	--	--	1B.1	X				
recurved larkspur	*Delphinium recurvatum*	--	--	1B.2	X	X		X	
red-flowered bird's-foot-trefoil	*Acmispon rubriflorus*	--	--	1B.1	X				
Robbins' nemacladus	*Nemacladus secundiflorus var. robbinsii*	--	--	1B.2				X	
rock sanicle	*Sanicula saxatilis*	--	CR	1B.2					X
round-leaved filaree	*California macrophylla*	--	--	1B.1	X	X	X	X	
saline clover	*Trifolium hydrophilum*	--	--	1B.2			X		
San Benito evening-primrose	*Camissonia benitensis*	FT	--	1B.1	X				
San Benito fritillary	*Fritillaria viridea*	--	--	1B.2	X	X			
San Benito pentachaeta	*Pentachaeta exilis ssp. aeolica*	--	--	1B.2	X				X
San Francisco collinsia	*Collinsia multicolor*	--	--	1B.2			X		
San Joaquin spearscale	*Atriplex joaquiniana*	--	--	1B.2	X	X	X		X
San Joaquin woollythreads	*Monolopia congdonii*	FE	--	1B.2		X			
Santa Clara Valley dudleya	*Dudleya abramsii ssp. setchellii*	FE	--	1B.1			X		X
Santa Cruz Mountains pussypaws	*Calyptridium parryi var. hesseae*	--	--	1B.1		X			X
Santa Lucia dwarf rush	*Juncus luciensis*	--	--	1B.2				X	
Sharsmith's harebell	*Campanula sharsmithiae*	--	--	1B.2	X				
Sharsmith's onion	*Allium sharsmithiae*	--	--	1B.3	X	X			
shining navarretia	*Navarretia nigelliformis ssp. radians*	--	--	1B.2	X	X		X	
showy golden madia	*Madia radiata*	--	--	1B.1	X	X			X
slender silver moss	*Anomobryum julaceum*	--	--	2.2			X		
smooth lessingia	*Lessingia micradenia var. glabrata*	--	--	1B.2			X		X
talus fritillary	*Fritillaria falcata*	--	--	1B.2	X	X			
Temblor buckwheat	*Eriogonum temblorense*	--	--	1B.2	X	X			
Tiburon paintbrush	*Castilleja affinis ssp. neglecta*	FE	CT	1B.2			X		
Tracy's eriastrum	*Eriastrum tracyi*	--	CR	1B.2	X				
woodland woollythreads	*Monolopia gracilens*	--	--	1B.2			X		X
Wildlife									
Alameda whipsnake	*Masticophis lateralis euryxanthus*	FT	CT	--	X	X	X		X
American badger	*Taxidea taxus*	--	--	CSC	X	X	X	X	X
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP			X	X	X
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X	X			X
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT	--	--			X		
big-eared kangaroo rat	*Dipodomys venustus elephantinus*	--	--	CSC	X			X	
blunt-nosed leopard lizard	*Gambelia sila*	FE	CE	FP		X			
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X	X	X
California condor	*Gymnogyps californianus*	FE	CE	--	X			X	
California red-legged frog	*Rana draytonii*	FT	--	CSC	X	X	X	X	X
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC	X	X	X	X	X
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X	X	X	X	X
Coast Range newt	*Taricha torosa*	--	--	CSC	X				
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	X	X	X	X
giant kangaroo rat	*Dipodomys ingens*	FE	CE	--		X			
golden eagle	*Aquila chrysaetos*	--	--	FP		X	X	X	X
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC		X			

Table I-2. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Central California Coast Ranges Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection				
		FESA	CESA	Other DFG	Diablo Range	Eastern Hills	Fremont-Livermore Hills and Valleys	Gabilan Range	Western Diablo Range
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC		X	X		
long-eared owl	*Asio otus*	--	--	CSC				X	
longhorn fairy shrimp	*Branchinecta longiantenna*	FE	--	--	X	X	X		X
Monterey dusky-footed woodrat	*Neotoma macrotis luciana*	--	--	CSC	X				
mountain plover	*Charadrius montanus*	FPT	--	CSC		X			
Nelson's antelope squirrel	*Ammospermophilus nelsoni*	--	CT	--	X	X			
northern harrier	*Circus cyaneus*	--	--	CSC	X	X	X		
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	X	X	X
Salinas pocket mouse	*Perognathus inornatus psammophilus*	--	--	CSC				X	
San Francisco dusky-footed woodrat	*Neotoma fuscipes annectens*	--	--	CSC			X		
San Joaquin kit fox	*Vulpes macrotis mutica*	FE	CT	--	X	X	X	X	X
San Joaquin roach	*Lavinia symmetricus ssp. 1*	--	--	CSC		X			
San Joaquin whipsnake	*Masticophis flagellum ruddocki*	--	--	CSC	X	X	X	X	
short-nosed kangaroo rat	*Dipodomys nitratoides brevinasus*	--	--	CSC		X			
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC	X	X		X	
steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	FT	--	--			X		
Swainson's hawk	*Buteo swainsoni*	--	CT	--		X			
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X	X	X	X	
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X	X		
Tulare grasshopper mouse	*Onychomys torridus tularensis*	--	--	CSC	X	X			
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC	X	X		X	
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	--	--		X			
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	--	--	X	X	X		
western mastiff bat	*Eumops perotis californicus*	--	--	CSC		X		X	
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC				X	
western spadefoot	*Spea hammondii*	--	--	CSC	X	X	X	X	
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--	X				
white-tailed kite	*Elanus leucurus*	--	--	FP		X	X	X	
yellow-breasted chat	*Icteria virens*	--	--	CSC	X				
Natural Communities									
Alkali Meadow	*Alkali Meadow*	--	--	--		X			
Alkali Seep	*Alkali Seep*	--	--	--		X			
Cismontane Alkali Marsh	*Cismontane Alkali Marsh*	--	--	--		X			
Great Valley Cottonwood Riparian Forest	*Great Valley Cottonwood Riparian Forest*	--	--	--		X			
Great Valley Mesquite Scrub	*Great Valley Mesquite Scrub*	--	--	--	X	X			
Monvero Residual Dunes	*Monvero Residual Dunes*	--	--	--		X			
North Central Coast Drainage Sacramento Sucker/Roach River	*North Central Coast Drainage Sacramento Sucker/Roach River*	--	--	--	X				X
Northern Claypan Vernal Pool	*Northern Claypan Vernal Pool*	--	--	--		X			
Northern Vernal Pool	*Northern Vernal Pool*	--	--	--	X				
Serpentine Bunchgrass	*Serpentine Bunchgrass*	--	--	--			X		
Sycamore Alluvial Woodland	*Sycamore Alluvial Woodland*	--	--	--	X	X	X		X
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--	X	X			
Valley Sink Scrub	*Valley Sink Scrub*	--	--	--		X	X	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-3. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Colorado Desert Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection		
		FESA	CESA	Other DFG	Borrego Valley-West Mesa	Coachella Valley	Imperial Valley
Plants							
Abrams' spurge	*Chamaesyce abramsiana*	--	--	2.2		X	X
Algodones Dunes sunflower	*Helianthus niveus ssp. tephrodes*	--	CE	1B.2	X		
annual rock-nettle	*Eucnide rupestris*	--	--	2.2	X		
Arizona pholistoma	*Pholistoma auritum var. arizonicum*	--	--	2.3	X		
Arizona spurge	*Chamaesyce arizonica*	--	--	2.3	X	X	
Baja California ipomopsis	*Ipomopsis effusa*	--	--	2.1	X		
Booth's evening-primrose	*Camissonia boothii ssp. boothii*	--	--	2.3		X	
bristly scaleseed	*Spermolepis echinata*	--	--	2.3	X		
brown turbans	*Malperia tenuis*	--	--	2.3	X		X
California ayenia	*Ayenia compacta*	--	--	2.3	X	X	
California satintail	*Imperata brevifolia*	--	--	2.1		X	X
California saw-grass	*Cladium californicum*	--	--	2.2		X	X
chaparral sand-verbena	*Abronia villosa var. aurita*	--	--	1B.1	X	X	X
cliff spurge	*Euphorbia misera*	--	--	2.2		X	
Coachella Valley milk-vetch	*Astragalus lentiginosus var. coachellae*	FE	--	1B.2		X	
Deep Canyon snapdragon	*Antirrhinum cyathiferum*	--	--	2.3	X		
desert spike-moss	*Selaginella eremophila*	--	--	2.2	X	X	
dwarf germander	*Teucrium cubense ssp. depressum*	--	--	2.2	X		
Emory's crucifixion-thorn	*Castela emoryi*	--	--	2.3	X		
flat-seeded spurge	*Chamaesyce platysperma*	--	--	1B.2	X	X	
Gander's cryptantha	*Cryptantha ganderi*	--	--	1B.1	X		
glandular ditaxis	*Ditaxis claryana*	--	--	2.2		X	
hairy stickleaf	*Mentzelia hirsutissima*	--	--	2.3	X		X
Harwood's eriastrum	*Eriastrum harwoodii*	--	--	1B.2	X		
Harwood's milk-vetch	*Astragalus insularis var. harwoodii*	--	--	2.2	X		
jackass-clover	*Wislizenia refracta ssp. refracta*	--	--	2.2		X	
Lancaster milk-vetch	*Astragalus preussii var. laxiflorus*	--	--	1B.1		X	
Latimer's woodland-gilia	*Saltugilia latimeri*	--	--	1B.2		X	
lemon lily	*Lilium parryi*	--	--	1B.2		X	
Little San Bernardino Mtns. linanthus	*Linanthus maculatus*	--	--	1B.2		X	
little-leaf elephant tree	*Bursera microphylla*	--	--	2.3	X		
Mecca-aster	*Xylorhiza cognata*	--	--	1B.2		X	
Mountain Springs bush lupine	*Lupinus excubitus var. medius*	--	--	1B.3	X		
mud nama	*Nama stenocarpum*	--	--	2.2			X
Orcutt's woody-aster	*Xylorhiza orcuttii*	--	--	1B.2	X		
Orocopia sage	*Salvia greatae*	--	--	1B.3		X	X
Palmer's jackass clover	*Wislizenia refracta ssp. palmeri*	--	--	2.2	X		
Parish's brittlescale	*Atriplex parishii*	--	--	1B.1		X	
Parish's desert-thorn	*Lycium parishii*	--	--	2.3	X		
Parry's spineflower	*Chorizanthe parryi var. parryi*	--	--	1B.1		X	
Peirson's milk-vetch	*Astragalus magdalenae var. peirsonii*	FT	CE	1B.2	X		
Peirson's pincushion	*Chaenactis carphoclinia var. peirsonii*	--	--	1B.3	X		
pink fairy-duster	*Calliandra eriophylla*	--	--	2.3	X		X
purple stemodia	*Stemodia durantifolia*	--	--	2.1		X	
pygmy lotus	*Acmispon haydonii*	--	--	1B.3	X		
sand evening-primrose	*Camissonia arenaria*	--	--	2.2		X	
sand food	*Pholisma sonorae*	--	--	1B.2	X		X
Santa Rosa Mountains leptosiphon	*Leptosiphon floribundus ssp. hallii*	--	--	1B.3	X		
singlewhorl burrobrush	*Ambrosia monogyra*	--	--	2.2		X	
slender cottonheads	*Nemacaulis denudata var. gracilis*	--	--	2.2	X	X	
slender-stem bean	*Phaseolus filiformis*	--	--	2.1		X	
smooth tarplant	*Centromadia pungens ssp. laevis*	--	--	1B.1	X		
spear-leaf matelea	*Matelea parvifolia*	--	--	2.3	X		
spiny-hair blazing star	*Mentzelia tricuspis*	--	--	2.1		X	
triple-ribbed milk-vetch	*Astragalus tricarinatus*	FE	--	1B.2		X	X
white-bracted spineflower	*Chorizanthe xanti var. leucotheca*	--	--	1B.2		X	
Wildlife							
American badger	*Taxidea taxus*	--	--	CSC	X	X	X
arroyo toad	*Anaxyrus californicus*	FE	--	CSC		X	
barefoot gecko	*Coleonyx switaki*	--	CT	--	X		
big free-tailed bat	*Nyctinomops macrotis*	--	--	CSC		X	X
black skimmer	*Rynchops niger*	--	--	CSC		X	X
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP	X		X
California brown pelican	*Pelecanus occidentalis californicus*	FD	CD	FP		X	X
California leaf-nosed bat	*Macrotus californicus*	--	--	CSC	X		
California red-legged frog	*Rana draytonii*	FT	--	CSC		X	
Casey's June beetle	*Dinacoma caseyi*	FPE	--	--		X	
Coachella Valley fringe-toed lizard	*Uma inornata*	FT	CE	--		X	
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X	X	
Colorado Desert fringe-toed lizard	*Uma notata*	--	--	CSC	X		
Couch's spadefoot	*Scaphiopus couchii*	--	--	CSC		X	X
Crissal thrasher	*Toxostoma crissale*	--	--	CSC		X	X
desert pupfish	*Cyprinodon macularius*	FE	CE	--	X	X	X
desert slender salamander	*Batrachoseps major aridus*	FE	CE	--		X	
desert tortoise	*Gopherus agassizii*	FT	CT	--		X	
flat-tailed horned lizard	*Phrynosoma mcallii*	--	--	CSC	X	X	X
Gila woodpecker	*Melanerpes uropygialis*	--	CE	--			X
gull-billed tern	*Gelochelidon nilotica*	--	--	CSC		X	X
Le Conte's thrasher	*Toxostoma lecontei*	--	--	CSC	X	X	
least Bell's vireo	*Vireo bellii pusillus*	FE	CE	--	X	X	
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC	X	X	
lowland (=Yavapai, San Sebastian & San Felipe) leopard frog	*Lithobates yavapaiensis*	--	--	CSC	X		X
mountain plover	*Charadrius montanus*	FPT	--	CSC		X	X
northern leopard frog	*Lithobates pipiens*	--	--	CSC			X
orangethroat whiptail	*Aspidoscelis hyperythra*	--	--	CSC		X	
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	
pallid San Diego pocket mouse	*Chaetodipus fallax pallidus*	--	--	CSC	X	X	
Palm Springs pocket mouse	*Perognathus longimembris bangsi*	--	--	CSC		X	X
Palm Springs round-tailed ground squirrel	*Xerospermophilus tereticaudus chlorus*	--	--	CSC		X	
peninsular bighorn sheep	*Ovis canadensis nelsoni DPS*	FE	CT	FP	X	X	
pocketed free-tailed bat	*Nyctinomops femorosaccus*	--	--	CSC	X	X	X
razorback sucker	*Xyrauchen texanus*	FE	CE	FP			X
red-diamond rattlesnake	*Crotalus ruber*	--	--	CSC	X	X	
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	--	--	CSC	X		
San Diego desert woodrat	*Neotoma lepida intermedia*	--	--	CSC		X	
sandstone night lizard	*Xantusia gracilis*	--	--	CSC	X		
short-eared owl	*Asio flammeus*	--	--	CSC			X
Sierra Madre yellow-legged frog	*Rana muscosa*	FE	CCE	CSC		X	
Sonoran desert toad	*Incilius alvarius*	--	--	CSC			X
southern rubber boa	*Charina umbratica*	--	CT	--		X	
spotted bat	*Euderma maculatum*	--	--	CSC		X	
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X		
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC		X	
vermilion flycatcher	*Pyrocephalus rubinus*	--	--	CSC		X	X
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X	X	X
western yellow bat	*Lasiurus xanthinus*	--	--	CSC	X	X	X
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC		X	X

Table I-3. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Colorado Desert Section

Common Name	Scientific Name	Status[1] FESA	Status[1] CESA	Status[1] Other DFG	USFS Ecological Subsection: Borrego Valley-West Mesa	USFS Ecological Subsection: Coachella Valley	USFS Ecological Subsection: Imperial Valley
yellow-breasted chat	*Icteria virens*	--	--	CSC		X	X
Yuma clapper rail	*Rallus longirostris yumanensis*	FE	CT	FP		X	X
Yuma hispid cotton rat	*Sigmodon hispidus eremicus*	--	--	CSC			X
Natural Communities							
Active Desert Dunes	*Active Desert Dunes*	--	--	--	X		
Crucifixion Thorn Woodland	*Crucifixion Thorn Woodland*	--	--	--	X		
Desert Fan Palm Oasis Woodland	*Desert Fan Palm Oasis Woodland*	--	--	--	X	X	X
Mesquite Bosque	*Mesquite Bosque*	--	--	--	X		
Stabilized and Partially Stabilized Desert Dunes	*Stabilized and Partially Stabilized Desert Dunes*	--	--	--	X		
Transmontane Alkali Marsh	*Transmontane Alkali Marsh*	--	--	--	X		

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-4. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Great Valley Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection													
		FESA	CESA	Other DFG	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins
Plants																		
adobe-lily	*Fritillaria pluriflora*	--	--	1B.2	X				X		X							
Ahart's dwarf rush	*Juncus leiospermus var. ahartii*	--	--	1B.2		X			X		X							
Ahart's paronychia	*Paronychia ahartii*	--	--	1B.1					X		X							
alkali mariposa-lily	*Calochortus striatus*	--	--	1B.2											X			
alkali milk-vetch	*Astragalus tener var. tener*	--	--	1B.2			X			X			X	X			X	X
Antioch Dunes buckwheat	*Eriogonum nudum var. psychicola*	--	--	1B.1													X	
Antioch Dunes evening-primrose	*Oenothera deltoides ssp. howellii*	FE	CE	1B.1			X										X	
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	--	--	1B.1	X				X		X			X				X
Bakersfield cactus	*Opuntia basilaris var. treleasei*	FE	CE	1B.1					X						X			
Bakersfield smallscale	*Atriplex tularensis*	--	CE	1A											X			
beaked clarkia	*Clarkia rostrata*	--	--	1B.3		X			X									
bearded popcorn-flower	*Plagiobothrys hystriculus*	--	--	1B.1			X							X				X
big tarplant	*Blepharizonia plumosa*	--	--	1B.1						X				X			X	
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2					X		X							
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	--	CE	1B.2		X			X		X			X				
Bolander's water-hemlock	*Cicuta maculata var. bolanderi*	--	--	2.1			X							X			X	X
Brandegee's clarkia	*Clarkia biloba ssp. brandegeeae*	--	--	1B.2					X									
Brazilian watermeal	*Wolffia brasiliensis*	--	--	2.3	X						X							
Brewer's western flax	*Hesperolinon breweri*	--	--	1B.2													X	
bristly sedge	*Carex comosa*	--	--	2.1			X							X				
brittlescale	*Atriplex depressa*	--	--	1B.2				X	X		X		X	X	X		X	X
Butte County checkerbloom	*Sidalcea robusta*	--	--	1B.2							X							
Butte County golden clover	*Trifolium jokerstii*	--	--	1B.2	X				X									
Butte County meadowfoam	*Limnanthes floccosa ssp. californica*	FE	CE	1B.1	X				X		X							
calico monkeyflower	*Mimulus pictus*	--	--	1B.2					X						X			
California chalk moss	*Pterygoneurum californicum*	--	--	1B.1											X			
California jewel-flower	*Caulanthus californicus*	FE	CE	1B.1				X	X						X			
California satintail	*Imperata brevifolia*	--	--	2.1				X	X						X			
California screw moss	*Tortula californica*	--	--	1B.2					X									
caper-fruited tropidocarpum	*Tropidocarpum capparideum*	--	--	1B.1			X	X	X		X						X	
Carquinez goldenbush	*Isocoma arguta*	--	--	1B.1			X							X				X
chaparral ragwort	*Senecio aphanactis*	--	--	2.2													X	
Colusa grass	*Neostapfia colusana*	FT	CE	1B.1		X			X	X		X	X	X				
Colusa layia	*Layia septentrionalis*	--	--	1B.2	X													
Comanche Point layia	*Layia leucopappa*	--	--	1B.1					X						X			
Congdon's tarplant	*Centromadia parryi ssp. congdonii*	--	--	1B.2			X										X	
Contra Costa goldfields	*Lasthenia conjugens*	FE	--	1B.1			X							X			X	
Contra Costa wallflower	*Erysimum capitatum var. angustatum*	FE	CE	1B.1			X										X	
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	--	--	1B.1							X		X		X	X		
Crampton's tuctoria or Solano grass	*Tuctoria mucronata*	FE	CE	1B.1										X				
Delta button-celery	*Eryngium racemosum*	--	CE	1B.1		X							X	X			X	
Delta mudwort	*Limosella subulata*	--	--	2.1			X							X			X	X
Delta tule pea	*Lathyrus jepsonii var. jepsonii*	--	--	1B.2			X							X			X	X
diamond-petaled California poppy	*Eschscholzia rhombipetala*	--	--	1B.1			X										X	
dwarf downingia	*Downingia pusilla*	--	--	2.2		X	X		X		X			X				
Earlimart orache	*Atriplex erecticaulis*	--	--	1B.2				X	X						X	X		
eel-grass pondweed	*Potamogeton zosteriformis*	--	--	2.2			X											
Ferris' milk-vetch	*Astragalus tener var. ferrisiae*	--	--	1B.1	X				X		X	X						X
fragrant fritillary	*Fritillaria liliacea*	--	--	1B.2										X				
Greene's tuctoria	*Tuctoria greenei*	FE	CR	1B.1	X	X		X	X	X	X							
hairy Orcutt grass	*Orcuttia pilosa*	FE	CE	1B.1		X		X	X		X							
Hall's tarplant	*Deinandra halliana*	--	--	1B.1													X	
Hartweg's golden sunburst	*Pseudobahia bahiifolia*	FE	CE	1B.1	X	X			X			X						
heartscale	*Atriplex cordulata*	--	--	1B.2	X			X	X	X		X	X	X	X		X	X
Heckard's pepper-grass	*Lepidium latipes var. heckardii*	--	--	1B.2									X	X				X
hispid bird's-beak	*Chloropyron molle ssp. hispidum*	--	--	1B.1					X				X	X	X			
Hoover's calycadenia	*Calycadenia hooveri*	--	--	1B.3		X			X									
Hoover's spurge	*Chamaesyce hooveri*	FT	--	1B.2		X			X	X	X							
Horn's milk-vetch	*Astragalus hornii var. hornii*	--	--	1B.1											X			
Ione buckwheat	*Eriogonum apricum var. apricum*	FE	CE	1B.1		X												
Ione manzanita	*Arctostaphylos myrtifolia*	FT	--	1B.2		X												
Irish Hill buckwheat	*Eriogonum apricum var. prostratum*	FE	CE	1B.1		X												
Kaweah brodiaea	*Brodiaea insignis*	--	CE	1B.2				X										
Keck's checkerbloom	*Sidalcea keckii*	FE	--	1B.1					X					X				
Kern mallow	*Eremalche kernensis*	FE	--	1B.1											X			
Kings gold	*Tropidocarpum californicum*	--	--	1B.1											X			
knotted rush	*Juncus nodosus*	--	--	2.3		X												
legenere	*Legenere limosa*	--	--	1B.1		X	X		X		X			X				
Lemmon's jewel-flower	*Caulanthus lemmonii*	--	--	1B.2											X		X	
lesser saltscale	*Atriplex minuscula*	--	--	1B.1	X			X	X	X			X	X	X		X	
Lost Hills crownscale	*Atriplex coronata var. vallicola*	--	--	1B.2				X							X		X	
Madera leptosiphon	*Leptosiphon serrulatus*	--	--	1B.2				X	X									
Mariposa cryptantha	*Cryptantha mariposae*	--	--	1B.3		X												
marsh skullcap	*Scutellaria galericulata*	--	--	2.2			X							X				
Mason's lilaeopsis	*Lilaeopsis masonii*	--	CR	1B.1			X							X			X	X
Mason's neststraw	*Stylocline masonii*	--	--	1B.1											X			
Merced phacelia	*Phacelia ciliata var. opaca*	--	--	1B.2					X	X								
Mt. Diablo buckwheat	*Eriogonum truncatum*	--	--	1B.1			X										X	
mud nama	*Nama stenocarpum*	--	--	2.2				X										
Munz's tidy-tips	*Layia munzii*	--	--	1B.2				X					X		X		X	
Northern California black walnut	*Juglans hindsii*	--	--	1B.1			X							X				X
oil neststraw	*Stylocline citroleum*	--	--	1B.1					X						X			
pale-yellow layia	*Layia heterotricha*	--	--	1B.1					X								X	
palmate-bracted bird's-beak	*Chloropyron palmatum*	FE	CE	1B.1				X						X				X
Panoche pepper-grass	*Lepidium jaredii ssp. album*	--	--	1B.2				X									X	
pappose tarplant	*Centromadia parryi ssp. parryi*	--	--	1B.2	X		X							X				
Parry's horkelia	*Horkelia parryi*	--	--	1B.2		X												
Peruvian dodder	*Cuscuta obtusiflora var. glandulosa*	--	--	2.2	X				X									
pincushion navarretia	*Navarretia myersii ssp. myersii*	--	--	1B.1		X			X									
pink creamsacs	*Castilleja rubicundula ssp. rubicundula*	--	--	1B.2	X				X		X							
Piute Mountains navarretia	*Navarretia setiloba*	--	--	1B.1					X						X			
prairie wedge grass	*Sphenopholis obtusata*	--	--	2.2						X								
prostrate vernal pool navarretia	*Navarretia prostrata*	--	--	1B.1						X			X				X	
recurved larkspur	*Delphinium recurvatum*	--	--	1B.2	X			X	X	X		X		X	X		X	
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	--	--	1B.1					X		X							
rose-flowered larkspur	*Delphinium purpusii*	--	--	1B.3					X									
round-leaved filaree	*California macrophylla*	--	--	1B.1	X				X		X			X			X	
Sacramento Orcutt grass	*Orcuttia viscida*	FE	CE	1B.1		X			X									
saline clover	*Trifolium hydrophilum*	--	--	1B.2			X		X					X				X
San Francisco campion	*Silene verecunda ssp. verecunda*	--	--	1B.2	X													
San Joaquin adobe sunburst	*Pseudobahia peirsonii*	FT	CE	1B.1				X	X									
San Joaquin spearscale	*Atriplex joaquiniana*	--	--	1B.2			X			X	X		X	X			X	X
San Joaquin Valley Orcutt grass	*Orcuttia inaequalis*	FT	CE	1B.1		X		X	X	X				X				
San Joaquin woollythreads	*Monolopia congdonii*	FE	--	1B.2					X						X		X	
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2		X	X	X	X	X	X		X	X				X
Santa Cruz tarplant	*Holocarpha macradenia*	FT	CE	1B.1			X											
Shevock's golden-aster	*Heterotheca shevockii*	--	--	1B.3					X									
shining navarretia	*Navarretia nigelliformis ssp. radians*	--	--	1B.2					X									
showy golden madia	*Madia radiata*	--	--	1B.1													X	
showy rancheria clover	*Trifolium amoenum*	FE	--	1B.1										X				
side-flowering skullcap	*Scutellaria lateriflora*	--	--	2.2			X							X				
silky cryptantha	*Cryptantha crinita*	--	--	1B.2							X							
slender Orcutt grass	*Orcuttia tenuis*	FT	CE	1B.1					X		X							
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2							X		X					
slough thistle	*Cirsium crassicaule*	--	--	1B.1										X	X	X		

Table I-4. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Great Valley Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection													
		FESA	CESA	Other DFG	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins
soft bird's-beak	*Chloropyron molle ssp. molle*	FE	CR	1B.2			X							X				
spiny-sepaled button-celery	*Eryngium spinosepalum*	--	--	1B.2		X		X	X	X								
Stony Creek spurge	*Chamaesyce ocellata ssp. rattanii*	--	--	1B.2							X							
striped adobe-lily	*Fritillaria striata*	--	CT	1B.1				X	X						X			
subtle orache	*Atriplex subtilis*	--	--	1B.2	X			X	X	X					X			
succulent owl's-clover	*Castilleja campestris ssp. succulenta*	FT	CE	1B.2		X			X	X								
Suisun Marsh aster	*Symphyotrichum lentum*	--	--	1B.2			X			X				X			X	X
Suisun thistle	*Cirsium hydrophilum var. hydrophilum*	FE	--	1B.1			X											
Tejon poppy	*Eschscholzia lemmonii ssp. kernensis*	--	--	1B.1											X			
Temblor buckwheat	*Eriogonum temblorense*	--	--	1B.2													X	
Tuolumne button-celery	*Eryngium pinnatisectum*	--	--	1B.2		X												
Vasek's clarkia	*Clarkia tembloriensis ssp. calientensis*	--	--	1B.1					X									
veiny monardella	*Monardella douglasii ssp. venosa*	--	--	1B.1	X				X			X						
vernal pool smallscale	*Atriplex persistens*	--	--	1B.2				X	X	X			X	X				
watershield	*Brasenia schreberi*	--	--	2.3	X		X							X				
woolly rose-mallow	*Hibiscus lasiocarpos var. occidentalis*	--	--	1B.2	X		X		X		X	X		X			X	X
Wright's trichocoronis	*Trichocoronis wrightii var. wrightii*	--	--	2.1								X	X	X				
Wildlife																		
Alameda whipsnake	*Masticophis lateralis euryxanthus*	FT	CT	--			X										X	
American badger	*Taxidea taxus*	--	--	CSC	X	X		X	X	X	X		X	X	X		X	X
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP	X		X		X		X							
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP		X			X			X			X			
bank swallow	*Riparia riparia*	--	CT	--	X	X	X	X	X		X	X						X
blunt-nosed leopard lizard	*Gambelia sila*	FE	CE	FP				X	X	X					X	X	X	
Buena Vista Lake shrew	*Sorex ornatus relictus*	FE	--	--											X			
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X	X	X	X	X			X	X	X	X	X
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP	X		X		X					X			X	
California clapper rail	*Rallus longirostris obsoletus*	FE	CE	FP			X											
California condor	*Gymnogyps californianus*	FE	CE	--					X									
California least tern	*Sternula antillarum browni*	FE	CE	FP			X											
California red-legged frog	*Rana draytonii*	FT	--	CSC													X	
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC	X	X		X	X	X			X	X			X	X
chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	FT	CT	--					X			X						X
chinook salmon - Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	FE	CE	--							X							X
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC				X					X		X		X	
Conservancy fairy shrimp	*Branchinecta conservatio*	FE	--	--					X	X	X		X	X				X
Delta green ground beetle	*Elaphrus viridis*	FT	--	--										X				
Delta smelt	*Hypomesus transpacificus*	FT	CE	--			X							X				X
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	--	--	CSC											X			
foothill yellow-legged frog	*Rana boylii*	--	--	CSC					X		X			X				
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	FE	CE	--				X	X									
fulvous whistling-duck	*Dendrocygna bicolor*	--	--	CSC											X	X		
giant garter snake	*Thamnophis gigas*	FT	CT	--	X		X	X	X	X	X	X	X	X	X		X	X
giant kangaroo rat	*Dipodomys ingens*	FE	CE	--											X		X	
golden eagle	*Aquila chrysaetos*	--	--	FP		X			X							X	X	
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC		X			X									X
greater sandhill crane	*Grus canadensis tabida*	--	CT	FP	X				X			X						
hardhead	*Mylopharodon conocephalus*	--	--	CSC		X			X	X			X	X				
Kern brook lamprey	*Entosphenus hubbsi*	--	--	CSC		X			X						X			
Lange's metalmark butterfly	*Apodemia mormo langei*	FE	--	--			X							X			X	
Le Conte's thrasher	*Toxostoma lecontei*	--	--	CSC											X			
least Bell's vireo	*Vireo bellii pusillus*	FE	CE	--										X				X
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC					X								X	
long-eared owl	*Asio otus*	--	--	CSC											X			
longhorn fairy shrimp	*Branchinecta longiantenna*	FE	--	--						X			X				X	
Marysville California kangaroo rat	*Dipodomys californicus eximius*	--	--	CSC	X													
mountain plover	*Charadrius montanus*	FPT	--	CSC		X		X	X			X	X	X	X	X	X	X
Nelson's antelope squirrel	*Ammospermophilus nelsoni*	--	CT	--				X	X				X		X	X	X	
northern harrier	*Circus cyaneus*	--	--	CSC	X	X	X		X				X				X	
northern leopard frog	*Lithobates pipiens*	--	--	CSC					X				X		X			
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X		X	X	X	X		X					
purple martin	*Progne subis*	--	--	CSC					X									X
riparian (=San Joaquin Valley) woodrat	*Neotoma fuscipes riparia*	FE	--	CSC										X			X	
riparian brush rabbit	*Sylvilagus bachmani riparius*	FE	CE	--										X			X	
Sacramento perch	*Archoplites interruptus*	--	--	CSC			X										X	X
Sacramento splittail	*Pogonichthys macrolepidotus*	--	--	CSC			X					X		X				X
saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	--	--	CSC			X											
salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE	CE	FP			X							X			X	
San Joaquin kit fox	*Vulpes macrotis mutica*	FE	CT	--		X	X	X	X	X			X		X	X	X	
San Joaquin whipsnake	*Masticophis flagellum ruddocki*	--	--	CSC				X							X		X	
short-eared owl	*Asio flammeus*	--	--	CSC			X											
short-nosed kangaroo rat	*Dipodomys nitratoides brevinasus*	--	--	CSC											X			

Table I-4. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Great Valley Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection													
		FESA	CESA	Other DFG	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--							X							
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC			X	X		X					X		X	
Suisun shrew	*Sorex ornatus sinuosus*	--	--	CSC			X											
Suisun song sparrow	*Melospiza melodia maxillaris*	--	--	CSC			X		X	X							X	
Swainson's hawk	*Buteo swainsoni*	--	CT	--	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	FE	CE	--				X	X						X	X		
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC		X					X							
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tulare grasshopper mouse	*Onychomys torridus tularensis*	--	--	CSC					X						X	X	X	
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC				X										
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	--	--	X	X	X	X	X	X	X	X		X				X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	--	--	X	X	X	X	X	X	X	X	X	X		X	X	X
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	--	--		X		X	X	X	X		X	X			X	X
western mastiff bat	*Eumops perotis californicus*	--	--	CSC		X		X	X	X	X	X			X			
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X	X	X	X	X	X	X	X	X	X	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC		X	X	X	X	X	X	X	X	X			X	
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC											X	X		X
western spadefoot	*Spea hammondii*	--	--	CSC		X		X	X	X			X		X		X	
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--	X			X	X		X	X		X	X			X
white-tailed kite	*Elanus leucurus*	--	--	FP		X			X		X			X	X		X	X
willow flycatcher	*Empidonax traillii*	--	CE	--					X									
yellow rail	*Coturnicops noveboracensis*	--	--	CSC									X				X	
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC					X		X			X				
yellow-breasted chat	*Icteria virens*	--	--	CSC		X			X		X							
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	--	--	CSC						X			X	X	X			X
Natural Communities																		
Alkali Meadow	*Alkali Meadow*	--	--	--					X								X	
Alkali Seep	*Alkali Seep*	--	--	--					X						X			
Central Valley Drainage Fall Run Chinook Stream	*Central Valley Drainage Fall Run Chinook Stream*	--	--	--							X							
Central Valley Drainage Hardhead/Squawfish Stream	*Central Valley Drainage Hardhead/Squawfish Stream*	--	--	--							X							
Central Valley Drainage Valley Floor River	*Central Valley Drainage Valley Floor River*	--	--	--							X							
Cismontane Alkali Marsh	*Cismontane Alkali Marsh*	--	--	--									X				X	
Coastal and Valley Freshwater Marsh	*Coastal and Valley Freshwater Marsh*	--	--	--	X		X	X	X	X	X	X	X	X			X	
Coastal Brackish Marsh	*Coastal Brackish Marsh*	--	--	--			X							X			X	
Elderberry Savanna	*Elderberry Savanna*	--	--	--					X					X				X
Great Valley Cottonwood Riparian Forest	*Great Valley Cottonwood Riparian Forest*	--	--	--					X		X	X		X	X		X	X
Great Valley Mesquite Scrub	*Great Valley Mesquite Scrub*	--	--	--											X			
Great Valley Mixed Riparian Forest	*Great Valley Mixed Riparian Forest*	--	--	--	X			X	X		X	X		X				
Great Valley Valley Oak Riparian Forest	*Great Valley Valley Oak Riparian Forest*	--	--	--	X		X	X	X		X	X		X				
Great Valley Willow Scrub	*Great Valley Willow Scrub*	--	--	--					X		X	X						
Ione Chaparral	*Ione Chaparral*	--	--	--		X												
Monvero Residual Dunes	*Monvero Residual Dunes*	--	--	--													X	
Northern Basalt Flow Vernal Pool	*Northern Basalt Flow Vernal Pool*	--	--	--					X									
Northern Claypan Vernal Pool	*Northern Claypan Vernal Pool*	--	--	--			X	X	X	X			X	X			X	
Northern Hardpan Vernal Pool	*Northern Hardpan Vernal Pool*	--	--	--	X	X		X	X	X	X	X		X				
Northern Volcanic Mud Flow Vernal Pool	*Northern Volcanic Mud Flow Vernal Pool*	--	--	--	X				X									
Stabilized Interior Dunes	*Stabilized Interior Dunes*	--	--	--					X								X	
Sycamore Alluvial Woodland	*Sycamore Alluvial Woodland*	--	--	--				X	X								X	
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--					X					X	X			
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--					X					X				
Valley Sacaton Grassland	*Valley Sacaton Grassland*	--	--	--				X	X				X		X	X		
Valley Saltbush Scrub	*Valley Saltbush Scrub*	--	--	--											X	X		
Valley Sink Scrub	*Valley Sink Scrub*	--	--	--				X					X		X	X	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest Ecological Subsection
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-5. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Klamath Mountains Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection				
		FESA	CESA	Other DFG	Eastern Klamath Mountains	Gasquet Mountains Ultramafics	Oregon Mountains	Upper Scott Mountains	Western Jurassic
Plants									
Aleppo avens	*Geum aleppicum*	--	--	2.2	X				
alkali hymenoxys	*Hymenoxys lemmonii*	--	--	2.2				X	
Bald Mountain milk-vetch	*Astragalus umbraticus*	--	--	2.3		X			X
blue alpine phacelia	*Phacelia sericea var. ciliosa*	--	--	2.3				X	
blushing wild buckwheat	*Eriogonum ursinum var. erubescens*	--	--	1B.3	X		X		
bristle-stalked sedge	*Carex leptalea*	--	--	2.2	X				X
bristly sedge	*Carex comosa*	--	--	2.1	X				
broad-nerved hump moss	*Meesia uliginosa*	--	--	2.2	X				
brownish beaked-rush	*Rhynchospora capitellata*	--	--	2.2	X				
buttercup-leaf suksdorfia	*Hemieva ranunculifolia*	--	--	2				X	
California globe mallow	*Iliamna latibracteata*	--	--	1B.2					X
Callahan's mariposa-lily	*Calochortus syntrophus*	--	--	1B.1	X				
Canadian buffalo-berry	*Shepherdia canadensis*	--	--	2.1				X	
Cantelow's lewisia	*Lewisia cantelovii*	--	--	1B.2	X				
Canyon Creek stonecrop	*Sedum obtusatum ssp. paradisum*	--	--	1B.3	X			X	
Cascade grass-of-Parnassus	*Parnassia cirrata var. intermedia*	--	--	2.2	X			X	
Cascade stonecrop	*Sedum divergens*	--	--	2.3				X	
Castle Crags harebell	*Campanula shetleri*	--	--	1B.3	X			X	
Castle Crags ivesia	*Ivesia longibracteata*	--	--	1B.3	X			X	
coast fawn lily	*Erythronium revolutum*	--	--	2.2		X			X
Coast Range lomatium	*Lomatium martindalei*	--	--	2.3		X			X
Columbia yellow cress	*Rorippa columbiae*	--	--	1B.2					X
crested potentilla	*Potentilla cristae*	--	--	1B.3	X			X	
cylindrical trichodon	*Trichodon cylindricus*	--	--	2.2				X	
Del Norte pyrrocoma	*Pyrrocoma racemosa var. congesta*	--	--	2.3		X			X
Dudley's rush	*Juncus dudleyi*	--	--	2.3	X		X	X	X
Engelmann spruce	*Picea engelmannii*	--	--	2.2				X	
English Peak greenbrier	*Smilax jamesii*	--	--	1B.3	X			X	
ghost-pipe	*Monotropa uniflora*	--	--	2.2		X			
giant fawn lily	*Erythronium oregonum*	--	--	2.2					X
golden alpine draba	*Draba aureola*	--	--	1B.3				X	
Great Basin claytonia	*Claytonia umbellata*	--	--	2.3				X	
great burnet	*Sanguisorba officinalis*	--	--	2.2		X			X
green yellow sedge	*Carex viridula var. viridula*	--	--	2.3		X			
Greene's mariposa-lily	*Calochortus greenei*	--	--	1B.2				X	
Heckner's lewisia	*Lewisia cotyledon var. heckneri*	--	--	1B.2	X		X	X	X
horned butterwort	*Pinguicula macroceras*	--	--	2.2		X		X	X
Howell's alkali grass	*Puccinellia howellii*	--	--	1B.1	X				
Howell's fawn lily	*Erythronium howellii*	--	--	1B.3		X			X
Howell's jewel-flower	*Streptanthus howellii*	--	--	1B.2		X			X
Howell's montia	*Montia howellii*	--	--	2.2					X
Howell's sandwort	*Minuartia howellii*	--	--	1B.3		X			X
Jepson's horkelia	*Horkelia daucifolia var. indicta*	--	--	1B.1				X	
Josephine horkelia	*Horkelia congesta ssp. nemorosa*	--	--	2.1					X
Klamath fawn lily	*Erythronium klamathense*	--	--	2.2	X			X	
Klamath manzanita	*Arctostaphylos klamathensis*	--	--	1B.2	X			X	
Klamath Mountain catchfly	*Silene salmonacea*	--	--	1B.2	X				
Koehler's stipitate rock-cress	*Arabis koehleri var. stipitata*	--	--	1B.3		X			X
leafy reed grass	*Calamagrostis foliosa*	--	CR	4.2		X			
little hulsea	*Hulsea nana*	--	--	2.3	X			X	
little-leaved huckleberry	*Vaccinium scoparium*	--	--	2.2		X		X	
Lyall's tonestus	*Tonestus lyallii*	--	--	2.3				X	
maidenhair spleenwort	*Asplenium trichomanes ssp. trichomanes*	--	--	2.3		X			X
Marble Mountain campion	*Silene marmorensis*	--	--	1B.2					X
marbled wild-ginger	*Asarum marmoratum*	--	--	2.3	X				X
marsh skullcap	*Scutellaria galericulata*	--	--	2.2	X				
Mason's sky pilot	*Polemonium chartaceum*	--	--	1B.3				X	
Mcdonald's rock-cress	*Arabis mcdonaldiana*	FE	CE	1B.1		X			X
Mendocino gentian	*Gentiana setigera*	--	--	1B.2		X			
Mt. Eddy draba	*Draba carnosula*	--	--	1B.3	X			X	
mud sedge	*Carex limosa*	--	--	2.2				X	
nodding vanilla-grass	*Hierochloe odorata*	--	--	2.3				X	
Norris' beard moss	*Didymodon norrisii*	--	--	2.2			X		
northern adder's-tongue	*Ophioglossum pusillum*	--	--	2.2	X				
northern clarkia	*Clarkia borealis ssp. borealis*	--	--	1B.3	X			X	
northern meadow sedge	*Carex praticola*	--	--	2.2					X
Nuttall's ribbon-leaved pondweed	*Potamogeton epihydrus*	--	--	2.2	X		X		
Nuttall's saxifrage	*Cascadia nuttallii*	--	--	2.1					X
opposite-leaved lewisia	*Lewisia oppositifolia*	--	--	2.2		X			X
Oregon fireweed	*Epilobium oreganum*	--	--	1B.2	X			X	
Oregon goldthread	*Coptis laciniata*	--	--	2.2		X			X
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2.3	X				
Pacific gilia	*Gilia capitata ssp. pacifica*	--	--	1B.2		X			X
Pickering's ivesia	*Ivesia pickeringii*	--	--	1B.2	X			X	
porcupine sedge	*Carex hystericina*	--	--	2.1	X				
rattlesnake fern	*Botrychium virginianum*	--	--	2.2	X				
robust false lupine	*Thermopsis robusta*	--	--	1B.2		X			X
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2	X				
scabrid alpine tarplant	*Anisocarpus scabridus*	--	--	1B.3	X				
Scott Mountain bedstraw	*Galium serpenticum ssp. scotticum*	--	--	1B.2				X	
Scott Mountain sandwort	*Minuartia stolonifera*	--	--	1B.3				X	
Scott Mountains fawn lily	*Erythronium citrinum var. roderickii*	--	--	1B.3	X			X	
Scott Valley phacelia	*Phacelia greenei*	--	--	1B.2				X	
seacoast ragwort	*Packera bolanderi var. bolanderi*	--	--	2.2		X			X
serpentine catchfly	*Silene serpentinicola*	--	--	1B.2		X			X
serpentine rockcress	*Boechera serpenticola*	--	--	1B.2			X		
serpentine sedge	*Carex serpenticola*	--	--	2.3		X			X
Shasta ageratina	*Ageratina shastensis*	--	--	1B.2	X				
Shasta chaenactis	*Chaenactis suffrutescens*	--	--	1B.3	X		X	X	
Shasta clarkia	*Clarkia borealis ssp. arida*	--	--	1B.1	X				
Shasta orthocarpus	*Orthocarpus pachystachyus*	--	--	1B.1				X	
Shasta snow-wreath	*Neviusia cliftonii*	--	--	1B.2	X				
showy raillardella	*Raillardella pringlei*	--	--	1B.2				X	
Sierra blue grass	*Poa sierrae*	--	--	1B.3	X				
silky balsamroot	*Balsamorhiza sericea*	--	--	1B.3				X	
silky cryptantha	*Cryptantha crinita*	--	--	1B.2	X				
Siskiyou fireweed	*Epilobium siskiyouense*	--	--	1B.3	X		X	X	
Siskiyou paintbrush	*Castilleja miniata ssp. elata*	--	--	2.2		X			X
Siskiyou phacelia	*Phacelia leonis*	--	--	1B.3	X			X	
slender silver moss	*Anomobryum julaceum*	--	--	2.2			X		
small groundcone	*Kopsiopsis hookeri*	--	--	2.3		X			X
subalpine aster	*Eurybia merita*	--	--	2.3	X			X	
subalpine fir	*Abies lasiocarpa var. lasiocarpa*	--	--	2.3				X	
Sulphur Creek brodiaea	*Brodiaea matsonii*	--	--	1B.1	X				
thread-leaved beardtongue	*Penstemon filiformis*	--	--	1B.3	X			X	
Tracy's beardtongue	*Penstemon tracyi*	--	--	1B.3				X	
Trinity buckwheat	*Eriogonum alpinum*	--	CE	1B.2	X			X	
Waldo daisy	*Erigeron bloomeri var. nudatus*	--	--	2.3				X	X
Waldo rock-cress	*Arabis aculeolata*	--	--	2.2		X			X
Waldo wild buckwheat	*Eriogonum pendulum*	--	--	2.2		X			X

Table I-5. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Klamath Mountains Section

Common Name	Scientific Name	Status[1] FESA	CESA	Other DFG	USFS Ecological Subsection: Eastern Klamath Mountains	Gasquet Mountains Ultramafics	Oregon Mountains	Upper Scott Mountains	Western Jurassic
water bulrush	*Schoenoplectus subterminalis*	--	--	2.3	X	X		X	X
wayside aster	*Eucephalus vialis*	--	--	1B.2					X
western ragwort	*Packera hesperia*	--	--	2.2					X
western white bog violet	*Viola primulifolia ssp. occidentalis*	--	--	1B.2		X			X
white beaked-rush	*Rhynchospora alba*	--	--	2.2				X	
white-flowered rein orchid	*Piperia candida*	--	--	1B.2		X	X		X
Wilkin's harebell	*Campanula wilkinsiana*	--	--	1B.2				X	
Wolf's evening-primrose	*Oenothera wolfii*	--	--	1B.1					X
woolly balsamroot	*Balsamorhiza lanata*	--	--	1B.2				X	
woolly pussy-toes	*Antennaria lanata*	--	--	2.2				X	
woolly-fruited sedge	*Carex lasiocarpa*	--	--	2.3	X				
yellow-tubered toothwort	*Cardamine nuttallii var. gemmata*	--	--	1B.3		X			X
Wildlife									
American badger	*Taxidea taxus*	--	--	CSC			X		
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP	X			X	X
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X		X	X	X
bigeye marbled sculpin	*Cottus klamathensis macrops*	--	--	CSC	X				
black swift	*Cypseloides niger*	--	--	CSC	X	X		X	X
bull trout	*Salvelinus confluentus*	FT	CE	--	X				
California wolverine	*Gulo gulo*	FC	CT	FP	X			X	X
Cascades frog	*Rana cascadae*	--	--	CSC	X			X	
chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	FT	CT	--	X				
chinook salmon - Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	FE	CE	--	X				
chinook salmon - spring-run Klamath-Trinity Rivers pop.	*Oncorhynchus tshawytscha*	--	--	CSC	X	X	X		X
coast cutthroat trout	*Oncorhynchus clarkii clarkii*	--	--	CSC		X			X
Del Norte salamander	*Plethodon elongatus*	--	--	CSC		X			X
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	X	X	X	X
golden eagle	*Aquila chrysaetos*	--	--	FP			X		
hardhead	*Mylopharodon conocephalus*	--	--	CSC	X				
Humboldt marten	*Martes americana humboldtensis*	--	--	CSC		X		X	X
mardon skipper	*Polites mardon*	FC	--	--		X			
McCloud River redband trout	*Oncorhynchus mykiss ssp. 2*	--	--	CSC	X				
northern goshawk	*Accipiter gentilis*	--	--	CSC	X	X	X	X	X
northern spotted owl	*Strix occidentalis caurina*	FT	--	CSC	X	X	X	X	X
Oregon snowshoe hare	*Lepus americanus klamathensis*	--	--	CSC	X		X		
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	--	CSC	X	X	X	X	X
Pacific tailed frog	*Ascaphus truei*	--	--	CSC	X	X	X	X	X
pallid bat	*Antrozous pallidus*	--	--	CSC	X		X		
Pit roach	*Lavinia symmetricus mitrulus*	--	--	CSC	X				
purple martin	*Progne subis*	--	--	CSC	X				
rough sculpin	*Cottus asperrimus*	--	CT	FP	X				
Shasta salamander	*Hydromantes shastae*	--	CT	--	X				
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--	X			X	
Siskiyou Mountains salamander	*Plethodon stormi*	--	CT	--					X
Sonoma tree vole	*Arborimus pomo*	--	--	CSC		X			X
southern torrent salamander	*Rhyacotriton variegatus*	--	--	CSC		X			X
spotted bat	*Euderma maculatum*	--	--	CSC	X			X	
summer-run steelhead trout	*Oncorhynchus mykiss irideus*	--	--	CSC		X	X	X	X
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X				
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X			X	
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC	X		X		
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--	X				
willow flycatcher	*Empidonax traillii*	--	CE	--	X				
Natural Communities									
Alkali Seep	*Alkali Seep*	--	--	--	X				
Darlingtonia Seep	*Darlingtonia Seep*	--	--	--	X	X		X	
Klamath/North Coast Fall/Winter Run Chinook Salmon River	*Klamath/North Coast Fall/Winter Run Chinook Salmon River*	--	--	--					X
Klamath/North Coast Interior Headwater Fishless Stream	*Klamath/North Coast Interior Headwater Fishless Stream*	--	--	--					X
Klamath/North Coast Rainbow Trout Stream	*Klamath/North Coast Rainbow Trout Stream*	--	--	--					X
Lower McCloud River/Canyon River	*Lower McCloud River/Canyon River*	--	--	--	X				
Lower Pit River/Canyon River (Hardhead/Tule Perch River)	*Lower Pit River/Canyon River (Hardhead/Tule Perch River)*	--	--	--	X				
Northern Interior Cypress Forest	*Northern Interior Cypress Forest*	--	--	--	X		X		
Pit River Drainage Rainbow/Redband Trout Stream	*Pit River Drainage Rainbow/Redband Trout Stream*	--	--	--	X				

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
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** CNDDB Occurrences associated to nearest
[1] Status definitions:

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- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
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- FD Delisted

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- CT Threatened
- CR Rare
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Other California Department of Fish and Game (DFG):
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- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
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    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
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    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
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Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-6. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Mojave Desert Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection		
		FESA	CESA	Other DFG	High Desert Plains and Hills	Providence Mountains-Lanfair Valley	Searles Valley-Owlshead Mountains
Plants							
Abert's sanvitalia	*Sanvitalia abertii*	--	--	2.2		X	
Abrams' spurge	*Chamaesyce abramsiana*	--	--	2.2		X	
alkali mariposa-lily	*Calochortus striatus*	--	--	1B.2	X		X
appressed muhly	*Muhlenbergia appressa*	--	--	2.2		X	
Arizona cottontop	*Digitaria californica*	--	--	2.3		X	
Aven Nelson's phacelia	*Phacelia anelsonii*	--	--	2.3		X	
Bakersfield cactus	*Opuntia basilaris var. treleasei*	FE	CE	1B.1	X		
Barstow woolly sunflower	*Eriophyllum mohavense*	--	--	1B.2	X		
Beaver Dam breadroot	*Pediomelum castoreum*	--	--	1B.2	X		
black bog-rush	*Schoenus nigricans*	--	--	2.2	X		
Booth's evening-primrose	*Camissonia boothii ssp. boothii*	--	--	2.3	X	X	X
Booth's hairy evening-primrose	*Camissonia boothii ssp. intermedia*	--	--	2.3			X
burro grass	*Scleropogon brevifolius*	--	--	2.3		X	
California ayenia	*Ayenia compacta*	--	--	2.3		X	
chaparral sand-verbena	*Abronia villosa var. aurita*	--	--	1B.1	X		
Charleston sandwort	*Eremogone congesta var. charlestonensis*	--	--	1B.3		X	
Charlotte's phacelia	*Phacelia nashiana*	--	--	1B.2	X		X
Cima milk-vetch	*Astragalus cimae var. cimae*	--	--	1B.2		X	
Clark Mountain spurge	*Euphorbia exstipulata var. exstipulata*	--	--	2.1		X	
Clokey's cryptantha	*Cryptantha clokeyi*	--	--	1B.2	X	X	
coyote gilia	*Aliciella triodon*	--	--	2.2		X	
creamy blazing star	*Mentzelia tridentata*	--	--	1B.3	X		
curved-spine beavertail	*Opuntia curvispina*	--	--	2.2		X	
Darwin rock-cress	*Arabis pulchra var. munciensis*	--	--	2.3	X		
Davidson's bush-mallow	*Malacothamnus davidsonii*	--	--	1B.2	X		
Death Valley round-leaved phacelia	*Phacelia mustelina*	--	--	1B.3			X
delicate muhly	*Muhlenbergia fragilis*	--	--	2.3		X	
desert ageratina	*Ageratina herbacea*	--	--	2.3		X	
desert bedstraw	*Galium proliferum*	--	--	2.2		X	
desert cymopterus	*Cymopterus deserticola*	--	--	1B.2	X		
desert mountain thistle	*Cirsium arizonicum var. tenuisectum*	--	--	1B.2		X	
desert pincushion	*Coryphantha chlorantha*	--	--	2.1		X	
Drummond's false pennyroyal	*Hedeoma drummondii*	--	--	2.2		X	
dwarf abutilon	*Abutilon parvulum*	--	--	2.3		X	
Emory's crucifixion-thorn	*Castela emoryi*	--	--	2.3	X	X	X
false buffalo-grass	*Munroa squarrosa*	--	--	2.2		X	
few-flowered muhly	*Muhlenbergia pauciflora*	--	--	2.3		X	
forked purple mat	*Nama dichotomum var. dichotomum*	--	--	2.3		X	
glandular ditaxis	*Ditaxis claryana*	--	--	2.2		X	
Greene's rabbitbrush	*Chrysothamnus greenei*	--	--	2.3			X
hairy erioneuron	*Erioneuron pilosum*	--	--	2.3		X	
hairy-podded fine-leaf hymenopappus	*Hymenopappus filifolius var. eriopodus*	--	--	2.3		X	
Harwood's eriastrum	*Eriastrum harwoodii*	--	--	1B.2		X	
hillside wheat grass	*Leymus salinus ssp. mojavensis*	--	--	2.3		X	
Horn's milk-vetch	*Astragalus hornii var. hornii*	--	--	1B.1	X		
Howe's hedgehog cactus	*Echinocereus engelmannii var. howei*	--	--	1B.1		X	
inland rush	*Juncus interior*	--	--	2.2		X	
juniper sulphur-flowered buckwheat	*Eriogonum umbellatum var. juniporinum*	--	--	2.3		X	
knotted rush	*Juncus nodosus*	--	--	2.3		X	
Lancaster milk-vetch	*Astragalus preussii var. laxiflorus*	--	--	1B.1	X		
Latimer's woodland-gilia	*Saltugilia latimeri*	--	--	1B.2		X	
lemon lily	*Lilium parryi*	--	--	1B.2	X		
limestone beardtongue	*Penstemon calcareus*	--	--	1B.3		X	
lobed ground-cherry	*Physalis lobata*	--	--	2.3		X	
long-stem evening-primrose	*Oenothera longissima*	--	--	2.2		X	
Madera leptosiphon	*Leptosiphon serrulatus*	--	--	1B.2	X		
many-flowered schkuhria	*Schkuhria multiflora var. multiflora*	--	--	2.3		X	
Mojave Desert plum	*Prunus eremophila*	--	--	1B.2		X	
Mojave menodora	*Menodora spinescens var. mohavensis*	--	--	1B.2	X		
Mojave milkweed	*Asclepias nyctaginifolia*	--	--	2.1	X	X	
Mojave monkeyflower	*Mimulus mohavensis*	--	--	1B.2	X		
Mojave tarplant	*Deinandra mohavensis*	--	CE	1B.3	X		
Mormon needle grass	*Stipa arida*	--	--	2.3		X	
narrow-leaved yerba santa	*Eriodictyon angustifolium*	--	--	2.3		X	
Nevada onion	*Allium nevadense*	--	--	2.3		X	X
New Mexico locust	*Robinia neomexicana*	--	--	2.3		X	
nine-awned pappus grass	*Enneapogon desvauxii*	--	--	2.2		X	
Orocopia sage	*Salvia greatae*	--	--	1B.3		X	
pale-yellow layia	*Layia heterotricha*	--	--	1B.1	X		
Palmer's mariposa-lily	*Calochortus palmeri var. palmeri*	--	--	1B.2	X		
Parish's club-cholla	*Grusonia parishii*	--	--	2.2		X	
Parish's phacelia	*Phacelia parishii*	--	--	1B.1	X		
Parish's popcorn-flower	*Plagiobothrys parishii*	--	--	1B.1	X		
Parry's spineflower	*Chorizanthe parryi var. parryi*	--	--	1B.1	X		
Piute Mountains navarretia	*Navarretia setiloba*	--	--	1B.1	X		
plains bee balm	*Monarda pectinata*	--	--	2.3		X	
plains flax	*Linum puberulum*	--	--	2.3		X	
plains stoneseed	*Lithospermum incisum*	--	--	2.3		X	
playa milk-vetch	*Astragalus allochrous var. playanus*	--	--	2.2		X	
Plummer's mariposa-lily	*Calochortus plummerae*	--	--	1B.2	X		
Plummer's woodsia	*Woodsia plummerae*	--	--	2.3		X	
Providence Mountains lotus	*Acmispon argyraeus var. notitius*	--	--	1B.3		X	
purple-nerve cymopterus	*Cymopterus multinervatus*	--	--	2.2		X	
recurved larkspur	*Delphinium recurvatum*	--	--	1B.2	X		
red four o'clock	*Mirabilis coccinea*	--	--	2.3		X	
Red Rock poppy	*Eschscholzia minutiflora ssp. twisselmannii*	--	--	1B.2	X		X
Red Rock tarplant	*Deinandra arida*	--	CR	1B.2	X		X
rigid fringepod	*Thysanocarpus rigidus*	--	--	1B.2		X	
Ripley's aliciella	*Aliciella ripleyi*	--	--	2.3	X		X
Robbins' nemacladus	*Nemacladus secundiflorus var. robbinsii*	--	--	1B.2	X		
rosy two-toned beardtongue	*Penstemon bicolor ssp. roseus*	--	--	1B.1		X	
rough menodora	*Menodora scabra*	--	--	2.3		X	
round-leaved filaree	*California macrophylla*	--	--	1B.1	X		
Rusby's desert-mallow	*Sphaeralcea rusbyi var. eremicola*	--	--	1B.2		X	
sagebrush loeflingia	*Loeflingia squarrosa var. artemisiarum*	--	--	2.2	X		
San Antonio milk-vetch	*Astragalus lentiginosus var. antonius*	--	--	1B.3	X		
San Bernardino aster	*Symphyotrichum defoliatum*	--	--	1B.2	X		
San Bernardino milk-vetch	*Astragalus bernardinus*	--	--	1B.2		X	
scaly cloak fern	*Astrolepis cochisensis ssp. cochisensis*	--	--	2.3		X	
scrub lotus	*Acmispon argyraeus var. multicaulis*	--	--	1B.3		X	
short-joint beavertail	*Opuntia basilaris var. brachyclada*	--	--	1B.2	X		
sky-blue phacelia	*Phacelia coerulea*	--	--	2.3		X	
small-flowered bird's-beak	*Cordylanthus parviflorus*	--	--	2.3		X	
southern mountains skullcap	*Scutellaria bolanderi ssp. austromontana*	--	--	1B.2	X		
southwestern false cloak-fern	*Argyrochosma limitanea ssp. limitanea*	--	--	2.3		X	
spear-leaf matelea	*Matelea parvifolia*	--	--	2.3		X	
spiny cliff-brake	*Pellaea truncata*	--	--	2.3		X	
Stephens' beardtongue	*Penstemon stephensii*	--	--	1B.3		X	

Table I-6. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Mojave Desert Section

Common Name	Scientific Name	Status[1] FESA	Status[1] CESA	Status[1] Other DFG	USFS Ecological Subsection: High Desert Plains and Hills	USFS Ecological Subsection: Providence Mountains-Lanfair Valley	USFS Ecological Subsection: Searles Valley-Owlshead Mountains
Thompson's beardtongue	*Penstemon thompsoniae*	--	--	2.3		X	
Thorne's buckwheat	*Eriogonum thornei*	--	CE	1B.2		X	
thorny milkwort	*Polygala acanthoclada*	--	--	2.3		X	
three-awned grama	*Bouteloua trifida*	--	--	2.3		X	
tough muhly	*Muhlenbergia arsenei*	--	--	2.3		X	
Utah beardtongue	*Penstemon utahensis*	--	--	2.3		X	
Utah daisy	*Erigeron utahensis*	--	--	2.3		X	
Utah glasswort	*Sarcocornia utahensis*	--	--	2.2	X		
violet twining snapdragon	*Maurandella antirrhiniflora*	--	--	2.3		X	
viviparous foxtail cactus	*Coryphantha vivipara var. rosea*	--	--	2.2		X	
white-bracted spineflower	*Chorizanthe xanti var. leucotheca*	--	--	1B.2	X		
white-margined beardtongue	*Penstemon albomarginatus*	--	--	1B.1		X	
wolftail	*Muhlenbergia alopecuroides*	--	--	2.2		X	
Wooton's lace fern	*Cheilanthes wootonii*	--	--	2.3		X	
Wright's bedstraw	*Galium wrightii*	--	--	2.3		X	
Wildlife							
American badger	*Taxidea taxus*	--	--	CSC	X	X	X
Arizona bell's vireo	*Vireo bellii arizonae*	--	CE	--		X	
arroyo toad	*Anaxyrus californicus*	FE	--	CSC	X		
banded gila monster	*Heloderma suspectum cinctum*	--	--	CSC		X	
Bendire's thrasher	*Toxostoma bendirei*	--	--	CSC		X	
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X
California red-legged frog	*Rana draytonii*	FT	--	CSC	X		
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X		
Crissal thrasher	*Toxostoma crissale*	--	--	CSC	X	X	X
desert tortoise	*Gopherus agassizii*	FT	CT	--	X	X	X
golden eagle	*Aquila chrysaetos*	--	--	FP	X		X
gray vireo	*Vireo vicinior*	--	--	CSC	X	X	
Inyo California towhee	*Melozone crissalis eremophilus*	FT	CE	--	X		X
Le Conte's thrasher	*Toxostoma lecontei*	--	--	CSC	X	X	X
least Bell's vireo	*Vireo bellii pusillus*	FE	CE	--	X		
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC	X		
long-eared owl	*Asio otus*	--	--	CSC	X		
Lucy's warbler	*Oreothlypis luciae*	--	--	CSC		X	
Mohave ground squirrel	*Xerospermophilus mohavensis*	--	CT	--	X		X
Mohave river vole	*Microtus californicus mohavensis*	--	--	CSC	X		
Mohave tui chub	*Siphateles bicolor mohavensis*	FE	CE	FP	X	X	
Mojave fringe-toed lizard	*Uma scoparia*	--	--	CSC	X	X	
mountain plover	*Charadrius montanus*	FPT	--	CSC	X		
Nelson's antelope squirrel	*Ammospermophilus nelsoni*	--	CT	--	X		
Owens Valley vole	*Microtus californicus vallicola*	--	--	CSC	X		
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	X
pallid San Diego pocket mouse	*Chaetodipus fallax pallidus*	--	--	CSC	X		
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	FE	--	CSC	X		
short-eared owl	*Asio flammeus*	--	--	CSC	X		
Sierra Madre yellow-legged frog	*Rana muscosa*	FE	CCE	CSC	X		
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC	X		
southern grasshopper mouse	*Onychomys torridus ramona*	--	--	CSC	X		
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	CE	--	X		
spotted bat	*Euderma maculatum*	--	--	CSC	X		X
summer tanager	*Piranga rubra*	--	--	CSC	X		
Swainson's hawk	*Buteo swainsoni*	--	CT	--	X	X	
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	--	--	CSC	X		
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X	X	X
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X		
Tulare grasshopper mouse	*Onychomys torridus tularensis*	--	--	CSC	X		X
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC	X		
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X		
western pond turtle	*Emys marmorata*	--	--	CSC	X		
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC	X		
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--	X		
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC	X		
yellow-breasted chat	*Icteria virens*	--	--	CSC	X	X	
Yuma clapper rail	*Rallus longirostris yumanensis*	FE	CT	FP	X		
Natural Communities							
Mojave Mixed Steppe	*Mojave Mixed Steppe*	--	--	--		X	
Mojave Riparian Forest	*Mojave Riparian Forest*	--	--	--	X	X	
Southern Cottonwood Willow Riparian Forest	*Southern Cottonwood Willow Riparian Forest*	--	--	--	X		
Southern Riparian Scrub	*Southern Riparian Scrub*	--	--	--	X		
Southern Sycamore Alder Riparian Woodland	*Southern Sycamore Alder Riparian Woodland*	--	--	--	X		
Southern Willow Scrub	*Southern Willow Scrub*	--	--	--	X		
Transmontane Alkali Marsh	*Transmontane Alkali Marsh*	--	--	--	X		
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--	X		
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--	X		
Wildflower Field	*Wildflower Field*	--	--	--	X		

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** CNDDB Occurrences associated to nearest
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- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
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    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

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Table I-7. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Mono Section

Common Name	Scientific Name	Status1			USFS Ecological Subsection	
		FESA	CESA	Other DFG	Bodie Hills-Excelsior Mountains	Mono Valley
Plants						
Alexander's buckwheat	*Eriogonum ochrocephalum var. alexanderae*	--	--	2.2	X	
alkali ivesia	*Ivesia kingii var. kingii*	--	--	2.2	X	
alkali tansy-sage	*Sphaeromeria potentilloides var. nitrophila*	--	--	2.2	X	
American manna grass	*Glyceria grandis*	--	--	2.3	X	
Bodie Hills cusickiella	*Cusickiella quadricostata*	--	--	1B.2	X	
Bodie Hills rock-cress	*Boechera bodiensis*	--	--	1B.3	X	
Booth's evening-primrose	*Camissonia boothii ssp. boothii*	--	--	2.3		X
common moonwort	*Botrychium lunaria*	--	--	2.3		X
cushion townsendia	*Townsendia condensata*	--	--	2.3	X	
Dugway wild buckwheat	*Eriogonum nutans var. nutans*	--	--	2.3	X	
dune horsebrush	*Tetradymia tetrameres*	--	--	2.2	X	X
foxtail thelypodium	*Thelypodium integrifolium ssp. complanatum*	--	--	2.2	X	X
frog's-bit buttercup	*Ranunculus hydrocharoides*	--	--	2.1	X	
globose cymopterus	*Cymopterus globosus*	--	--	2.2	X	
golden violet	*Viola purpurea ssp. aurea*	--	--	2.2	X	X
Great Basin onion	*Allium atrorubens var. atrorubens*	--	--	2.3	X	
Hall's meadow hawksbeard	*Crepis runcinata ssp. hallii*	--	--	2.1	X	
intermontane lupine	*Lupinus pusillus var. intermontanus*	--	--	2.3	X	X
intermountain milkwort	*Polygala intermontana*	--	--	2.3	X	
Inyo County star-tulip	*Calochortus excavatus*	--	--	1B.1	X	
lance-leaved scurf-pea	*Psoralidium lanceolatum*	--	--	2.3	X	X
Lavin's milk-vetch	*Astragalus oophorus var. lavinii*	--	--	1B.2	X	
Long Valley milk-vetch	*Astragalus johannis-howellii*	--	CR	1B.2	X	
many-flowered thelypodium	*Thelypodium milleflorum*	--	--	2.2	X	X
Masonic Mountain jewel-flower	*Streptanthus oliganthus*	--	--	1B.2	X	X
Masonic rock-cress	*Boechera cobrensis*	--	--	2.3	X	X
Mono County phacelia	*Phacelia monoensis*	--	--	1B.1	X	
Mono Lake lupine	*Lupinus duranii*	--	--	1B.2		X
Parish's popcorn-flower	*Plagiobothrys parishii*	--	--	1B.1	X	
prairie wedge grass	*Sphenopholis obtusata*	--	--	2.2	X	
silver bladderpod	*Physaria ludoviciana*	--	--	2.2		X
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2	X	
spiny milk-vetch	*Astragalus kentrophyta var. ungulatus*	--	--	2.2		X
Suksdorf's broom-rape	*Orobanche ludoviciana var. arenosa*	--	--	2.3	X	
Tonopah milk-vetch	*Astragalus pseudiodanthus*	--	--	1B.2		X
Torrey's blazing star	*Mentzelia torreyi*	--	--	2.2	X	X
Utah monkeyflower	*Mimulus glabratus ssp. utahensis*	--	--	2.1		X
Wheeler's dune-broom	*Chaetadelpha wheeleri*	--	--	2.2		X
Williams' combleaf	*Polyctenium williamsiae*	--	--	1B.2	X	
Wildlife						
Amargosa pupfish	*Cyprinodon nevadensis amargosae*	--	--	CSC	X	
bank swallow	*Riparia riparia*	--	CT	--		X
greater sage-grouse	*Centrocercus urophasianus*	FC	--	CSC	X	
Mount Lyell shrew	*Sorex lyelli*	--	--	CSC	X	X
northern goshawk	*Accipiter gentilis*	--	--	CSC		X
northern harrier	*Circus cyaneus*	--	--	CSC		X
pygmy rabbit	*Brachylagus idahoensis*	--	--	CSC	X	X
Sierra Nevada mountain beaver	*Aplodontia rufa californica*	--	--	CSC		X
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--		X
Sierra Nevada yellow-legged frog	*Rana sierrae*	FC	CCE	CSC		X
spotted bat	*Euderma maculatum*	--	--	CSC		X
western mastiff bat	*Eumops perotis californicus*	--	--	CSC		X
western white-tailed jackrabbit	*Lepus townsendii townsendii*	--	--	CSC	X	X
willow flycatcher	*Empidonax traillii*	--	CE	--		X
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC		X
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	--	--	CSC		X
Natural Community						
Mono Pumice Flat	*Mono Pumice Flat*	--	--	--		X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-8. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge
Plants												
alkali milk-vetch	*Astragalus tener var. tener*	--	--	1B.2			X			X		
alpine marsh violet	*Viola palustris*	--	--	2.2	X	X		X			X	
American manna grass	*Glyceria grandis*	--	--	2.3		X						X
arctic spoonwort**	*Cochlearia officinalis var. arctica*	--	--	2.3							X	
arctic starflower	*Trientalis europaea*	--	--	2.2							X	
Baker's goldfields	*Lasthenia californica ssp. bakeri*	--	--	1B.2		X	X		X			
Baker's larkspur	*Delphinium bakeri*	FE	CE	1B.1		X	X		X			
Baker's manzanita	*Arctostaphylos bakeri ssp. bakeri*	--	CR	1B.1		X						
Baker's meadowfoam	*Limnanthes bakeri*	--	CR	1B.1		X						
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	--	--	1B.1		X	X		X	X		
Bald Mountain milk-vetch	*Astragalus umbraticus*	--	--	2.3							X	X
beach layia	*Layia carnosa*	FE	CE	1B.1		X		X	X			X
beaked tracyina	*Tracyina rostrata*	--	--	1B.2		X						
bensoniella	*Bensoniella oregona*	--	CR	1B.1	X							X
bent-flowered fiddleneck	*Amsinckia lunaris*	--	--	1B.2			X		X	X		
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2						X		
Blasdale's bent grass	*Agrostis blasdalei*	--	--	1B.2		X	X		X			
blue coast gilia	*Gilia capitata ssp. chamissonis*	--	--	1B.1		X	X		X			
Bolander's beach pine	*Pinus contorta ssp. bolanderi*	--	--	1B.2		X						
Bolander's water-hemlock	*Cicuta maculata var. bolanderi*	--	--	2.1					X			
bristle-stalked sedge	*Carex leptalea*	--	--	2.2	X			X	X			
bristly sedge	*Carex comosa*	--	--	2.1		X	X					
brownish beaked-rush	*Rhynchospora capitellata*	--	--	2.2		X	X					
Burke's goldfields	*Lasthenia burkei*	FE	CE	1B.1			X			X		
California beaked-rush	*Rhynchospora californica*	--	--	1B.1		X	X		X	X		
California globe mallow	*Iliamna latibracteata*	--	--	1B.2	X						X	X
California sedge	*Carex californica*	--	--	2.3		X						
Calistoga ceanothus	*Ceanothus divergens*	--	--	1B.2						X		
Calistoga popcorn-flower	*Plagiobothrys strictus*	FE	CT	1B.1						X		
Clara Hunt's milk-vetch	*Astragalus claranus*	FE	CT	1B.1						X		
coast fawn lily	*Erythronium revolutum*	--	--	2.2	X	X		X			X	X
coast lily	*Lilium maritimum*	--	--	1B.1		X			X			
coast sidalcea	*Sidalcea oregana ssp. eximia*	--	--	1B.2	X			X			X	X
coast yellow leptosiphon	*Leptosiphon croceus*	--	--	1B.1					X			
coastal bluff morning-glory	*Calystegia purpurata ssp. saxicola*	--	--	1B.2		X	X		X			
coastal marsh milk-vetch	*Astragalus pycnostachyus var. pycnostachyus*	--	--	1B.2		X		X	X			
coastal triquetrella	*Triquetrella californica*	--	--	1B.2		X	X		X	X	X	
Cobb Mountain lupine	*Lupinus sericatus*	--	--	1B.2		X				X		
Colusa layia	*Layia septentrionalis*	--	--	1B.2						X		
Contra Costa goldfields	*Lasthenia conjugens*	FE	--	1B.1		X	X			X		
Crystal Springs lessingia	*Lessingia arachnoidea*	--	--	1B.2		X						
cylindrical trichodon	*Trichodon cylindricus*	--	--	2.2	X			X				X
dark-eyed gilia	*Gilia millefoliata*	--	--	1B.2		X	X	X	X		X	
deceiving sedge	*Carex saliniformis*	--	--	1B.2		X	X					X
Del Norte buckwheat	*Eriogonum nudum var. paralinum*	--	--	2.2							X	
Delta tule pea	*Lathyrus jepsonii var. jepsonii*	--	--	1B.2						X		
Diablo helianthella	*Helianthella castanea*	--	--	1B.2					X			
dwarf alkali grass	*Puccinellia pumila*	--	--	2.2		X		X				
dwarf downingia	*Downingia pusilla*	--	--	2.2			X			X		
dwarf soaproot	*Chlorogalum pomeridianum var. minus*	--	--	1B.2		X						
elongate copper moss	*Mielichhoferia elongata*	--	--	2.2					X			
few-flowered navarretia	*Navarretia leucocephala ssp. pauciflora*	FE	CT	1B.1						X		
fibrous pondweed	*Potamogeton foliosus ssp. fibrillosus*	--	--	2.3							X	
fragrant fritillary	*Fritillaria liliacea*	--	--	1B.2		X	X		X	X		
Franciscan onion	*Allium peninsulare var. franciscanum*	--	--	1B.2			X			X		
Franciscan thistle	*Cirsium andrewsii*	--	--	1B.2			X		X			
ghost-pipe	*Monotropa uniflora*	--	--	2.2				X			X	X
giant fawn lily	*Erythronium oregonum*	--	--	2.2	X	X						X
glandular western flax	*Hesperolinon adenophyllum*	--	--	1B.2		X						
golden larkspur	*Delphinium luteum*	FE	CR	1B.1		X	X					
grass alisma	*Alisma gramineum*	--	--	2.2		X						
great burnet	*Sanguisorba officinalis*	--	--	2.2	X	X					X	X
green jewel-flower	*Streptanthus hesperidis*	--	--	1B.2						X		
green yellow sedge	*Carex viridula var. viridula*	--	--	2.3		X		X			X	X
Greene's narrow-leaved daisy	*Erigeron greenei*	--	--	1B.2		X				X		
hair-leaved rush	*Juncus supiniformis*	--	--	2.2		X						
Hall's harmonia	*Harmonia hallii*	--	--	1B.2						X		
Henderson's fawn lily	*Erythronium hendersonii*	--	--	2.3							X	
Hitchcock's blue-eyed grass	*Sisyrinchium hitchcockii*	--	--	1B.1		X						
Hoffman's bristly jewel-flower	*Streptanthus glandulosus ssp. hoffmanii*	--	--	1B.3		X	X					
holly-leaved ceanothus	*Ceanothus purpureus*	--	--	1B.2		X				X		
horned butterwort	*Pinguicula macroceras*	--	--	2.2							X	
Howell's jewel-flower	*Streptanthus howellii*	--	--	1B.2							X	
Howell's montia	*Montia howellii*	--	--	2.2	X	X		X			X	X
Howell's sandwort	*Minuartia howellii*	--	--	1B.3							X	
Howell's spineflower	*Chorizanthe howellii*	FE	CT	1B.2		X						
Humboldt Bay owl's-clover	*Castilleja ambigua ssp. humboldtiensis*	--	--	1B.2	X	X	X	X	X			
Humboldt Bay wallflower	*Erysimum menziesii ssp. eurekense*	FE	CE	1B.1				X				
Humboldt milk-vetch	*Astragalus agnicidus*	--	CE	1B.1	X	X						
inundated bog-clubmoss	*Lycopodiella inundata*	--	--	2.2				X				
Jepson's leptosiphon	*Leptosiphon jepsonii*	--	--	1B.2		X	X			X		
Kellogg's buckwheat	*Eriogonum kelloggii*	FC	CE	1B.2		X						
Kellogg's horkelia	*Horkelia cuneata ssp. sericea*	--	--	1B.1					X			
Kenwood Marsh checkerbloom	*Sidalcea oregana ssp. valida*	FE	CE	1B.1						X		
Kneeland Prairie pennycress	*Noccaea fendleri ssp. californica*	FE	--	1B.1	X							
Koch's cord moss	*Entosthodon kochii*	--	--	1B.3					X			
Koehler's stipitate rock-cress	*Arabis koehleri var. stipitata*	--	--	1B.3							X	
Konocti manzanita	*Arctostaphylos manzanita ssp. elegans*	--	--	1B.3						X		
lagoon sedge	*Carex lenticularis var. limnophila*	--	--	2.2	X	X		X			X	X
Langsdorf's violet	*Viola langsdorfii*	--	--	2.1							X	
leafy reed grass	*Calamagrostis foliosa*	--	CR	4.2		X					X	
legenere	*Legenere limosa*	--	--	1B.1			X			X		
Loch Lomond button-celery	*Eryngium constancei*	FE	CE	1B.1						X		
Lyngbye's sedge	*Carex lyngbyei*	--	--	2.2		X		X	X		X	
Mad River fleabane daisy	*Erigeron maniopotamicus*	--	--	1B.2	X							
many-flowered navarretia	*Navarretia leucocephala ssp. plieantha*	FE	CE	1B.2			X					
Marin checker lily	*Fritillaria lanceolata var. tristulis*	--	--	1B.1					X			
Marin checkerbloom	*Sidalcea hickmanii ssp. viridis*	--	--	1B.3		X	X		X			
Marin County navarretia	*Navarretia rosulata*	--	--	1B.2					X			
Marin manzanita	*Arctostaphylos virgata*	--	--	1B.2					X			
Marin western flax	*Hesperolinon congestum*	FT	CT	1B.1					X			
marsh checkerbloom	*Sidalcea oregana ssp. hydrophila*	--	--	1B.2						X		
marsh microseris	*Microseris paludosa*	--	--	1B.2		X	X		X	X		
marsh pea	*Lathyrus palustris*	--	--	2.2		X		X			X	
Mason's ceanothus	*Ceanothus masonii*	--	CR	1B.2					X			
Mason's lilaeopsis	*Lilaeopsis masonii*	--	CR	1B.1					X**	X		
Mcdonald's rock-cress	*Arabis mcdonaldiana*	FE	CE	1B.1		X					X	
Mendocino Coast paintbrush	*Castilleja mendocinensis*	--	--	1B.2		X		X				
Mendocino dodder	*Cuscuta pacifica var. papillata*	--	--	1B.2		X	X					
Menzies' wallflower	*Erysimum menziesii ssp. menziesii*	FE	CE	1B.1		X						

Table I-8. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge
minute pocket moss	*Fissidens pauperculus*	--	--	1B.2		X		X	X		X	
Monterey clover	*Trifolium trichocalyx*	FE	CE	1B.1		X						
Mount Tamalpais bristly jewel-flower	*Streptanthus glandulosus ssp. pulchellus*	--	--	1B.2					X			
mountain crowberry	*Empetrum nigrum ssp. hermaphroditum*	--	--	2.2				X			X	
Mt. Tamalpais manzanita	*Arctostaphylos montana ssp. montana*	--	--	1B.3					X	X		
Mt. Tamalpais thistle	*Cirsium hydrophilum var. vaseyi*	--	--	1B.2					X			
Mt. Vision ceanothus	*Ceanothus gloriosus var. porrectus*	--	--	1B.3					X			
naked flag moss	*Discelium nudum*	--	--	2.2				X			X	
Napa blue grass	*Poa napensis*	FE	CE	1B.1						X		
Napa bluecurls	*Trichostema ruygtii*	--	--	1B.2						X		
Napa checkerbloom	*Sidalcea hickmanii ssp. napensis*	--	--	1B.1						X		
Napa false indigo	*Amorpha californica var. napensis*	--	--	1B.2		X	X		X	X		
Napa western flax	*Hesperolinon sp. nov. "serpentinum"*	--	--	1B.1						X		
narrow-anthered California brodiaea	*Brodiaea californica var. leptandra*	--	--	1B.2		X	X			X		
nodding vanilla-grass	*Hierochloe odorata*	--	--	2.3							X	
Norris' beard moss	*Didymodon norrisii*	--	--	2.2	X	X						
North Coast phacelia	*Phacelia insularis var. continentis*	--	--	1B.2		X			X			
North Coast semaphore grass	*Pleuropogon hooverianus*	--	CT	1B.1		X			X	X		
Northern California black walnut	*Juglans hindsii*	--	--	1B.1						X		
northern clustered sedge	*Carex arcta*	--	--	2.2	X	X		X				X
northern meadow sedge	*Carex praticola*	--	--	2.2				X			X	
northern microseris	*Microseris borealis*	--	--	2.1		X						X
Nuttall's ribbon-leaved pondweed	*Potamogeton epihydrus*	--	--	2.2		X						
Oregon coast paintbrush	*Castilleja affinis ssp. litoralis*	--	--	2.2	X	X		X			X	X
Oregon fireweed	*Epilobium oreganum*	--	--	1B.2	X							X
Oregon goldthread	*Coptis laciniata*	--	--	2.2	X	X					X	X
Oregon polemonium	*Polemonium carneum*	--	--	2.2	X	X	X	X	X		X	
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2.3		X	X			X		
Pacific gilia	*Gilia capitata ssp. pacifica*	--	--	1B.2	X	X		X			X	
pappose tarplant	*Centromadia parryi ssp. parryi*	--	--	1B.2			X			X		
Pennell's bird's-beak	*Cordylanthus tenuis ssp. capillaris*	FE	CR	1B.2		X						
perennial goldfields	*Lasthenia californica ssp. macrantha*	--	--	1B.2		X	X		X			
Peruvian dodder	*Cuscuta obtusiflora var. glandulosa*	--	--	2.2			X					
pink sand-verbena	*Abronia umbellata var. breviflora*	--	--	1B.1		X	X	X	X		X	X
Pitkin Marsh lily	*Lilium pardalinum ssp. pitkinense*	FE	CE	1B.1		X	X					
Pitkin Marsh paintbrush	*Castilleja uliginosa*	--	CE	1A		X						
Point Reyes bird's-beak	*Chloropyron maritimum ssp. palustre*	--	--	1B.2			X	X	X	X		
Point Reyes blennosperma	*Blennosperma nanum var. robustum*	--	CR	1B.2		X			X			
Point Reyes checkerbloom	*Sidalcea calycosa ssp. rhizomata*	--	--	1B.2		X	X		X			
Point Reyes horkelia	*Horkelia marinensis*	--	--	1B.2		X	X		X			
Point Reyes meadowfoam	*Limnanthes douglasii ssp. sulphurea*	--	CE	1B.2					X			
Point Reyes rein orchid	*Piperia elegans ssp. decurtata*	--	--	1B.1					X			
purple-stemmed checkerbloom	*Sidalcea malviflora ssp. purpurea*	--	--	1B.2		X	X		X			
pygmy cypress	*Hesperocyparis pygmaea*	--	--	1B.2		X						
pygmy manzanita	*Arctostaphylos nummularia ssp. mendocinoensis*	--	--	1B.2		X						
Raiche's manzanita	*Arctostaphylos stanfordiana ssp. raichei*	--	--	1B.1		X						
Raiche's red ribbons	*Clarkia concinna ssp. raichei*	--	--	1B.1			X		X			
Red Mountain stonecrop	*Sedum laxum ssp. eastwoodiae*	FC	--	1B.2		X						
Rincon Ridge ceanothus	*Ceanothus confusus*	--	--	1B.1		X	X			X		
Rincon Ridge manzanita	*Arctostaphylos stanfordiana ssp. decumbens*	--	--	1B.1		X	X			X		
robust false lupine	*Thermopsis robusta*	--	--	1B.2		X					X	X
robust spineflower	*Chorizanthe robusta var. robusta*	FE	--	1B.1					X			
Roderick's fritillary	*Fritillaria roderickii*	--	CE	1B.1		X						
rose leptosiphon	*Leptosiphon rosaceus*	--	--	1B.1		X	X		X			
round-headed beaked-rush	*Rhynchospora globularis*	--	--	2.1		X	X					
round-headed Chinese-houses	*Collinsia corymbosa*	--	--	1B.2		X						
round-leaved filaree	*California macrophylla*	--	--	1B.1			X					
saline clover	*Trifolium hydrophilum*	--	--	1B.2		X	X			X		
San Francisco Bay spineflower	*Chorizanthe cuspidata var. cuspidata*	--	--	1B.2			X		X			
San Francisco collinsia	*Collinsia multicolor*	--	--	1B.2					X			
San Francisco owl's-clover	*Triphysaria floribunda*	--	--	1B.2			X		X			
San Joaquin spearscale	*Atriplex joaquiniana*	--	--	1B.2						X		
sand dune phacelia	*Phacelia argentea*	--	--	1B.1							X	
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2							X	
Santa Cruz clover	*Trifolium buckwestiorum*	--	--	1B.1		X						
Santa Cruz microseris	*Stebbinsoseris decipiens*	--	--	1B.2					X			
Santa Cruz tarplant	*Holocarpha macradenia*	FT	CE	1B.1					X			
Santa Lucia dwarf rush	*Juncus luciensis*	--	--	1B.2						X		
seacoast ragwort	*Packera bolanderi var. bolanderi*	--	--	2.2	X	X		X			X	
seaside pea	*Lathyrus japonicus*	--	--	2.1	X			X			X	X
seaside tarplant	*Hemizonia congesta ssp. congesta*	--	--	1B.2		X	X		X	X		
Sebastopol meadowfoam	*Limnanthes vinculans*	FE	CE	1B.1		X	X			X		
serpentine catchfly	*Silene serpentinicola*	--	--	1B.2							X	
serpentine cryptantha	*Cryptantha dissita*	--	--	1B.1						X		
serpentine daisy	*Erigeron serpentinus*	--	--	1B.3		X						
serpentine sedge	*Carex serpenticola*	--	--	2.3							X	
short-leaved evax	*Hesperevax sparsiflora var. brevifolia*	--	--	1B.2		X	X	X	X		X	
showy rancheria clover	*Trifolium amoenum*	FE	--	1B.1		X	X		X	X		
Sierra rush	*Juncus nevadensis var. inventus*	--	--	2.2				X				
Siskiyou checkerbloom	*Sidalcea malviflora ssp. patula*	--	--	1B.2	X	X		X			X	
slender silver moss	*Anomobryum julaceum*	--	--	2.2		X		X		X		
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2						X		
small groundcone	*Kopsiopsis hookeri*	--	--	2.3		X			X		X	
small-flowered calycadenia	*Calycadenia micrantha*	--	--	1B.2						X		
Snow Mountain buckwheat	*Eriogonum nervulosum*	--	--	1B.2						X		
Socrates Mine jewel-flower	*Streptanthus brachiatus ssp. brachiatus*	--	--	1B.2						X		
soft bird's-beak	*Chloropyron molle ssp. molle*	FE	CR	1B.2						X		
Sonoma alopecurus	*Alopecurus aequalis var. sonomensis*	FE	--	1B.1		X	X		X	X		
Sonoma beardtongue	*Penstemon newberryi var. sonomensis*	--	--	1B.3						X		
Sonoma canescent manzanita	*Arctostaphylos canescens ssp. sonomensis*	--	--	1B.2		X	X			X		
Sonoma ceanothus	*Ceanothus sonomensis*	--	--	1B.2						X		
Sonoma spineflower	*Chorizanthe valida*	FE	CE	1B.1		X	X		X			
Sonoma sunshine	*Blennosperma bakeri*	FE	CE	1B.1			X			X		
Suisun Marsh aster	*Symphyotrichum lentum*	--	--	1B.2						X		
supple daisy	*Erigeron supplex*	--	--	1B.2		X			X			
swamp harebell	*Campanula californica*	--	--	1B.2		X	X		X			
Tamalpais jewel-flower	*Streptanthus batrachopus*	--	--	1B.3					X			
Tamalpais lessingia	*Lessingia micradenia var. micradenia*	--	--	1B.2					X			
Tamalpais oak	*Quercus parvula var. tamalpaisensis*	--	--	1B.3					X			
The Cedars buckwheat	*Eriogonum cedrorum*	--	--	1B.3		X						
The Cedars fairy-lantern	*Calochortus raichei*	--	--	1B.2		X						
The Cedars manzanita	*Arctostaphylos bakeri ssp. sublaevis*	--	CR	1B.2		X						
thin-lobed horkelia	*Horkelia tenuiloba*	--	--	1B.2		X	X		X	X		
Thurber's reed grass	*Calamagrostis crassiglumis*	--	--	2.1		X			X		X	
Tiburon buckwheat	*Eriogonum luteolum var. caninum*	--	--	1B.2					X			
Tiburon jewel-flower	*Streptanthus glandulosus ssp. niger*	FE	CE	1B.1					X			
Tiburon mariposa-lily	*Calochortus tiburonensis*	FT	CT	1B.1					X			
Tiburon paintbrush	*Castilleja affinis ssp. neglecta*	FE	CT	1B.2					X			
Tidestrom's lupine	*Lupinus tidestromii*	FE	CE	1B.1			X		X			
Tracy's romanzoffia	*Romanzoffia tracyi*	--	--	2.3				X			X	
two-carpellate western flax	*Hesperolinon bicarpellatum*	--	--	1B.2						X		
two-flowered pea	*Lathyrus biflorus*	--	--	1B.1	X							

Table I-8. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge
Vine Hill ceanothus	*Ceanothus foliosus var. vineatus*	--	--	1B.1		X	X					
Vine Hill clarkia	*Clarkia imbricata*	FE	CE	1B.1		X						
Vine Hill manzanita	*Arctostaphylos densiflora*	--	CE	1B.1		X	X					
Waldo daisy	*Erigeron bloomeri var. nudatus*	--	--	2.3				X				
watershield	*Brasenia schreberi*	--	--	2.3		X						
western leatherwood	*Dirca occidentalis*	--	--	1B.2		X	X		X			
western lily	*Lilium occidentale*	FE	CE	1B.1		X		X			X	
western sand-spurrey	*Spergularia canadensis var. occidentalis*	--	--	2.1				X				
white beaked-rush	*Rhynchospora alba*	--	--	2.2		X						
white sedge	*Carex albida*	FE	CE	1B.1		X	X					
white-flowered rein orchid	*Piperia candida*	--	--	1B.2	X	X					X	X
white-rayed pentachaeta	*Pentachaeta bellidiflora*	FE	CE	1B.1					X			
Whitney's farewell-to-spring	*Clarkia amoena ssp. whitneyi*	--	--	1B.1		X		X				
Wolf's evening-primrose	*Oenothera wolfii*	--	--	1B.1		X		X			X	X
woolly-headed gilia	*Gilia capitata ssp. tomentosa*	--	--	1B.1		X	X		X			
woolly-headed spineflower	*Chorizanthe cuspidata var. villosa*	--	--	1B.2			X		X			
yellow-tubered toothwort	*Cardamine nuttallii var. gemmata*	--	--	1B.3							X	
Wildlife												
American badger	*Taxidea taxus*	--	--	CSC		X	X		X	X		
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP	X	X				X		
ashy storm-petrel	*Oceanodroma homochroa*	--	--	CSC		X			X[**]			
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X	X		X		X	X	
bank swallow	*Riparia riparia*	--	CT	--		X	X	X			X	
Behren's silverspot butterfly	*Speyeria zerene behrensii*	FE	--	--		X						X
black swift	*Cypseloides niger*	--	--	CSC			X		X	X	X	
burrowing owl	*Athene cunicularia*	--	--	CSC			X		X	X		
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP			X		X	X		
California clapper rail	*Rallus longirostris obsoletus*	FE	CE	FP				X	X	X		
California freshwater shrimp	*Syncaris pacifica*	FE	CE	--		X	X		X	X		
California red-legged frog	*Rana draytonii*	FT	--	CSC		X	X		X	X		
California spotted owl	*Strix occidentalis occidentalis*	--	--	CSC		X						
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC			X					
chinook salmon - California coastal ESU	*Oncorhynchus tshawytscha*	FT	--	--		X						
coast cutthroat trout	*Oncorhynchus clarkii clarkii*	--	--	CSC	X	X		X			X	X
coho salmon - central California coast ESU	*Oncorhynchus kisutch*	FE	CE	--			X		X			
coho salmon - southern Oregon / northern California ESU	*Oncorhynchus kisutch*	FT	CT	CSC		X		X				
Del Norte salamander	*Plethodon elongatus*	--	--	CSC	X			X			X	X
Delta smelt	*Hypomesus transpacificus*	FT	CE	--						X		
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	X	X	X	X	X	X	X
fork-tailed storm-petrel	*Oceanodroma furcata*	--	--	CSC				X			X	
golden eagle	*Aquila chrysaetos*	--	--	FP	X	X				X		
green sturgeon	*Acipenser medirostris*	FT	--	CSC				X				
Guadalupe fur-seal**	*Arctocephalus townsendi*	FT	CT	FP					X			
Gualala roach	*Lavinia symmetricus parvipinnis*	--	--	CSC		X						
Hippolyta frittilary	*Speyeria zerene hippolyta*	FT	--	--							X	
Humboldt marten	*Martes americana humboldtensis*	--	--	CSC	X	X		X			X	X
little willow flycatcher	*Empidonax traillii brewsteri*	--	CE	--		X						
lotis blue butterfly	*Plebejus idas lotis*	FE	--	--		X						
marbled murrelet*	*Brachyramphus marmoratus*	FT	CE	--	X	X	X	X	X		X	
mardon skipper	*Polites mardon*	FC	--	--							X	
Mission blue butterfly	*Plebejus icarioides missionensis*	FE	--	--					X			
Myrtle's silverspot	*Speyeria zerene myrtleae*	FE	--	--		X	X		X			
Navarro roach	*Lavinia symmetricus navarroensis*	--	--	CSC		X	X			X		
northern goshawk	*Accipiter gentilis*	--	--	CSC		X						
northern harrier	*Circus cyaneus*	--	--	CSC					X	X		
northern red-legged frog	*Rana aurora*	--	--	CSC	X	X		X			X	X
northern spotted owl	*Strix occidentalis caurina*	FT	--	CSC	X	X	X	X	X	X	X	X
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	--	CSC	X	X					X	X
Pacific tailed frog	*Ascaphus truei*	--	--	CSC	X	X		X			X	X
pallid bat	*Antrozous pallidus*	--	--	CSC		X	X	X	X	X	X	
pink salmon	*Oncorhynchus gorbuscha*	--	--	CSC		X						
Point Arena mountain beaver	*Aplodontia rufa nigra*	FE	--	CSC		X						
Point Arena mountain beaver**	*Aplodontia rufa nigra*	FE	--	CSC		X						
Point Reyes jumping mouse	*Zapus trinotatus orarius*	--	--	CSC					X			
Point Reyes mountain beaver	*Aplodontia rufa phaea*	--	--	CSC					X			
purple martin	*Progne subis*	--	--	CSC		X				X		
Russian River tule perch	*Hysterocarpus traski pomo*	--	--	CSC		X	X					
Sacramento splittail	*Pogonichthys macrolepidotus*	--	--	CSC			X			X		
saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	--	--	CSC			X		X	X		
salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE	CE	FP			X		X	X		
San Bruno elfin butterfly	*Callophrys mossii bayensis*	FE	--	--			X		X			
San Pablo song sparrow	*Melospiza melodia samuelis*	--	--	CSC			X		X	X		
Sonoma tree vole	*Arborimus pomo*	--	--	CSC	X	X	X	X			X	X
southern sea otter	*Enhydra lutris nereis*	FT	--	--					X			
southern torrent salamander	*Rhyacotriton variegatus*	--	--	CSC	X	X		X			X	X
steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	FT	--	--		X	X		X	X		
steelhead - northern California DPS	*Oncorhynchus mykiss irideus*	FT	--	--		X						
Steller (=northern) sea-lion**	*Eumetopias jubatus*	FT	--	--					X		X	
Suisun shrew	*Sorex ornatus sinuosus*	--	--	CSC						X		
Suisun song sparrow	*Melospiza melodia maxillaris*	--	--	CSC						X		
summer-run steelhead trout	*Oncorhynchus mykiss irideus*	--	--	CSC	X	X						X
tidewater goby	*Eucyclogobius newberryi*	FE	--	CSC	X	X	X	X	X	X	X	X
Tomales roach	*Lavinia symmetricus ssp. 2*	--	--	CSC					X			
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC		X	X		X	X		
tricolored blackbird	*Agelaius tricolor*	--	--	CSC		X	X	X	X	X		
tufted puffin	*Fratercula cirrhata*	--	--	CSC		X	X[**]	X[**]	X		X[**]	
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X	X	X	X	X	
western red bat	*Lasiurus blossevillii*	--	--	CSC		X			X			
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC	X	X	X	X	X	X	X	
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--		X	X	X		X		
white-footed vole	*Arborimus albipes*	--	--	CSC	X			X				
white-tailed kite	*Elanus leucurus*	--	--	FP		X	X		X	X	X	
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC		X			X			
yellow-breasted chat	*Icteria virens*	--	--	CSC		X						
Natural Communities												
Central Dune Scrub	*Central Dune Scrub*	--	--	--					X			
Coastal and Valley Freshwater Marsh	*Coastal and Valley Freshwater Marsh*	--	--	--		X	X		X	X	X	X
Coastal Brackish Marsh	*Coastal Brackish Marsh*	--	--	--		X	X		X	X	X	
Coastal Douglas Fir Western Hemlock Forest	*Coastal Douglas Fir Western Hemlock Forest*	--	--	--		X						
Coastal Terrace Prairie	*Coastal Terrace Prairie*	--	--	--		X	X	X	X			
Fen	*Fen*	--	--	--		X						
Grand Fir Forest	*Grand Fir Forest*	--	--	--		X						
Mendocino Pygmy Cypress Forest	*Mendocino Pygmy Cypress Forest*	--	--	--		X						
North Central Coast Fall-Run Steelhead Stream	*North Central Coast Fall-Run Steelhead Stream*	--	--	--		X						
North Central Coast Summer Steelhead Stream	*North Central Coast Summer Steelhead Stream*	--	--	--	X							
Northern Coastal Bluff Scrub	*Northern Coastal Bluff Scrub*	--	--	--		X						
Northern Coastal Salt Marsh	*Northern Coastal Salt Marsh*	--	--	--		X	X	X	X	X	X	
Northern Foredune Grassland	*Northern Foredune Grassland*	--	--	--				X				
Northern Hardpan Vernal Pool	*Northern Hardpan Vernal Pool*	--	--	--			X					
Northern Interior Cypress Forest	*Northern Interior Cypress Forest*	--	--	--		X						
Northern Maritime Chaparral	*Northern Maritime Chaparral*	--	--	--					X			

Table I-8. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge
Northern Vernal Pool	*Northern Vernal Pool*	--	--	--			X		X	X		
Serpentine Bunchgrass	*Serpentine Bunchgrass*	--	--	--					X			
Sitka Spruce Forest	*Sitka Spruce Forest*	--	--	--				X			X	X
Sphagnum Bog	*Sphagnum Bog*	--	--	--		X		X				
Upland Douglas Fir Forest	*Upland Douglas Fir Forest*	--	--	--	X	X						
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--					X**	X		
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--		X						

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest Ecological Subsection
[1] Status definitions:

Federal Endangered Species Act (FESA):
FE Endangered
FT Threatened
FPE Proposed Endangered
FPT Proposed Threatened
FC Candidate
FD Delisted

California Endangered Species Act (CESA):
CE Endangered
CT Threatened
CR Rare
CCE Candidate Endangered
CD Delisted

Other California Department of Fish and Game (DFG):
FP Fully Protected under the California Fish and Game Code
CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
California Rare Plant Rank (CRPR):
List 1A Plants Presumed Extinct in California
List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 4 Plants of Limited Distribution - A Watch List
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-9. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Coast Ranges Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection	
		FESA	CESA	Other DFG	Central Franciscan	Clear Lake Hills and Valleys
Plants						
adobe-lily	*Fritillaria pluriflora*	--	--	1B.2	X	X
Anthony Peak lupine	*Lupinus antoninus*	--	--	1B.3	X	
Baker's meadowfoam	*Limnanthes bakeri*	--	CR	1B.1	X	
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	--	--	1B.1	X	
Bald Mountain milk-vetch	*Astragalus umbraticus*	--	--	2.3	X	
beaked tracyina	*Tracyina rostrata*	--	--	1B.2	X	X
bent-flowered fiddleneck	*Amsinckia lunaris*	--	--	1B.2	X	X
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2	X	
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	--	CE	1B.2	X	X
Bolander's horkelia	*Horkelia bolanderi*	--	--	1B.2	X	
Brandegee's eriastrum	*Eriastrum brandegeeae*	--	--	1B.2	X	X
bristly sedge	*Carex comosa*	--	--	2.1	X	
Burke's goldfields	*Lasthenia burkei*	FE	CE	1B.1	X	X
California globe mallow	*Iliamna latibracteata*	--	--	1B.2	X	
California satintail	*Imperata brevifolia*	--	--	2.1	X	
Calistoga ceanothus	*Ceanothus divergens*	--	--	1B.2	X	
coast fawn lily	*Erythronium revolutum*	--	--	2.2	X	
coast range bindweed	*Calystegia collina ssp. tridactylosa*	--	--	1B.2	X	
Cobb Mountain lupine	*Lupinus sericatus*	--	--	1B.2	X	
Colusa layia	*Layia septentrionalis*	--	--	1B.2	X	X
cylindrical trichodon	*Trichodon cylindricus*	--	--	2.2	X	
deep-scarred cryptantha	*Cryptantha excavata*	--	--	1B.3	X	
drymaria-like western flax	*Hesperolinon drymarioides*	--	--	1B.2	X	
eel-grass pondweed	*Potamogeton zosteriformis*	--	--	2.2	X	X
elongate copper moss	*Mielichhoferia elongata*	--	--	2.2	X	
few-flowered navarretia	*Navarretia leucocephala ssp. pauciflora*	FE	CT	1B.1	X	X
Franciscan onion	*Allium peninsulare var. franciscanum*	--	--	1B.2	X	
Freed's jewel-flower	*Streptanthus brachiatus ssp. hoffmanii*	--	--	1B.2	X	
Geysers dichanthelium	*Dichanthelium lanuginosum var. thermale*	--	CE	1B.1	X	
giant fawn lily	*Erythronium oregonum*	--	--	2.2	X	
glandular western flax	*Hesperolinon adenophyllum*	--	--	1B.2	X	X
grass alisma	*Alisma gramineum*	--	--	2.2	X	
Greene's narrow-leaved daisy	*Erigeron greenei*	--	--	1B.2	X	
Guggolz's harmonia	*Harmonia guggolziorum*	--	--	1B.1	X	
Hall's bush-mallow	*Malacothamnus hallii*	--	--	1B.2	X	
Hall's harmonia	*Harmonia hallii*	--	--	1B.2	X	X
Howell's montia	*Montia howellii*	--	--	2.2	X	
Jepson's dodder	*Cuscuta jepsonii*	--	--	1B.2	X	
Jepson's leptosiphon	*Leptosiphon jepsonii*	--	--	1B.2	X	
Jepson's milk-vetch	*Astragalus rattanii var. jepsonianus*	--	--	1B.2	X	X
Kellogg's buckwheat	*Eriogonum kelloggii*	FC	CE	1B.2	X	
Kenwood Marsh checkerbloom	*Sidalcea oregana ssp. valida*	FE	CE	1B.1	X	
Koch's cord moss	*Entosthodon kochii*	--	--	1B.3	X	
Konocti manzanita	*Arctostaphylos manzanita ssp. elegans*	--	--	1B.3	X	X
Lake County stonecrop	*Sedella leiocarpa*	FE	CE	1B.1	X	
legenere	*Legenere limosa*	--	--	1B.1	X	
Loch Lomond button-celery	*Eryngium constancei*	FE	CE	1B.1	X	
Mad River fleabane daisy	*Erigeron maniopotamicus*	--	--	1B.2	X	
many-flowered navarretia	*Navarretia leucocephala ssp. plieantha*	FE	CE	1B.2	X	
marsh checkerbloom	*Sidalcea oregana ssp. hydrophila*	--	--	1B.2	X	
marsh microseris	*Microseris paludosa*	--	--	1B.2	X	
Mcdonald's rock-cress	*Arabis mcdonaldiana*	FE	CE	1B.1	X	
Mendocino gentian	*Gentiana setigera*	--	--	1B.2	X	
Milo Baker's lupine	*Lupinus milo-bakeri*	--	CT	1B.1	X	
Napa bluecurls	*Trichostema ruygtii*	--	--	1B.2		X
Napa false indigo	*Amorpha californica var. napensis*	--	--	1B.2	X	
Napa western flax	*Hesperolinon sp. nov. "serpentinum"*	--	--	1B.1	X	
Norris' beard moss	*Didymodon norrisii*	--	--	2.2	X	X
North Coast semaphore grass	*Pleuropogon hooverianus*	--	CT	1B.1	X	
northern clustered sedge	*Carex arcta*	--	--	2.2	X	
Nuttall's ribbon-leaved pondweed	*Potamogeton epihydrus*	--	--	2.2	X	
Oregon fireweed	*Epilobium oreganum*	--	--	1B.2	X	
Oregon goldthread	*Coptis laciniata*	--	--	2.2	X	
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2.3	X	
Pacific gilia	*Gilia capitata ssp. pacifica*	--	--	1B.2	X	
pappose tarplant	*Centromadia parryi ssp. parryi*	--	--	1B.2		X
Raiche's manzanita	*Arctostaphylos stanfordiana ssp. raichei*	--	--	1B.1	X	
Red Mountain catchfly	*Silene campanulata ssp. campanulata*	--	CE	4.2	X	
Red Mountain stonecrop	*Sedum laxum ssp. eastwoodiae*	FC	--	1B.2	X	
Rincon Ridge ceanothus	*Ceanothus confusus*	--	--	1B.1	X	
Roderick's fritillary	*Fritillaria roderickii*	--	CE	1B.1	X	
round-leaved filaree	*California macrophylla*	--	--	1B.1	X	
scabrid alpine tarplant	*Anisocarpus scabridus*	--	--	1B.3	X	
Sebastopol meadowfoam	*Limnanthes vinculans*	FE	CE	1B.1	X	
serpentine cryptantha	*Cryptantha dissita*	--	--	1B.1	X	X
Siskiyou checkerbloom	*Sidalcea malviflora ssp. patula*	--	--	1B.2	X	
slender Orcutt grass	*Orcuttia tenuis*	FT	CE	1B.1	X	
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2	X	
small groundcone	*Kopsiopsis hookeri*	--	--	2.3	X	
small-flowered calycadenia	*Calycadenia micrantha*	--	--	1B.2	X	X
Snow Mountain buckwheat	*Eriogonum nervulosum*	--	--	1B.2	X	
Socrates Mine jewel-flower	*Streptanthus brachiatus ssp. brachiatus*	--	--	1B.2	X	
Sonoma beardtongue	*Penstemon newberryi var. sonomensis*	--	--	1B.3	X	
Sonoma canescent manzanita	*Arctostaphylos canescens ssp. sonomensis*	--	--	1B.2	X	
South Fork Mtn. lupine	*Lupinus elmeri*	--	--	1B.2	X	
The Lassics lupine	*Lupinus constancei*	--	--	1B.2	X	
The lassics sandwort	*Minuartia decumbens*	--	--	1B.2	X	
thin-lobed horkelia	*Horkelia tenuiloba*	--	--	1B.2	X	
two-carpellate western flax	*Hesperolinon bicarpellatum*	--	--	1B.2	X	X
two-flowered pea	*Lathyrus biflorus*	--	--	1B.1	X	
watershield	*Brasenia schreberi*	--	--	2.3	X	X
white-flowered rein orchid	*Piperia candida*	--	--	1B.2	X	
Wildlife						
American badger	*Taxidea taxus*	--	--	CSC	X	X
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP	X	
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X	
burrowing owl	*Athene cunicularia*	--	--	CSC	X	
California freshwater shrimp	*Syncaris pacifica*	FE	CE	--	X	
Clear Lake hitch	*Lavinia exilicauda chi*	--	--	CSC	X	X
coast cutthroat trout	*Oncorhynchus clarkii clarkii*	--	--	CSC	X	
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	X
golden eagle	*Aquila chrysaetos*	--	--	FP	X	
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC	X	
hardhead	*Mylopharodon conocephalus*	--	--	CSC	X	
Humboldt marten	*Martes americana humboldtensis*	--	--	CSC	X	
northern goshawk	*Accipiter gentilis*	--	--	CSC	X	
northern spotted owl	*Strix occidentalis caurina*	FT	--	CSC	X	
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	--	CSC	X	
Pacific tailed frog	*Ascaphus truei*	--	--	CSC	X	
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X

Table I-9. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Coast Ranges Section

Common Name	Scientific Name	Status[1] FESA	CESA	Other DFG	USFS Ecological Subsection Central Franciscan	Clear Lake Hills and Valleys
purple martin	*Progne subis*	--	--	CSC	X	
Russian River tule perch	*Hysterocarpus traski pomo*	--	--	CSC	X	
Sacramento perch	*Archoplites interruptus*	--	--	CSC	X	X
Sonoma tree vole	*Arborimus pomo*	--	--	CSC	X	
southern torrent salamander	*Rhyacotriton variegatus*	--	--	CSC	X	
steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	FT	--	--	X	
summer-run steelhead trout	*Oncorhynchus mykiss irideus*	--	--	CSC	X	
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X	
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X
western pond turtle	*Emys marmorata*	--	--	CSC	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC	X	
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--	X	X
white-tailed kite	*Elanus leucurus*	--	--	FP	X	
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC	X	
yellow-breasted chat	*Icteria virens*	--	--	CSC	X	
Natural Communities						
Central Valley Drainage Rainbow Trout/Cyprinid Stream	*Central Valley Drainage Rainbow Trout/Cyprinid Stream*	--	--	--	X	
Clear Lake Drainage Cyprinid/Catostomid Stream	*Clear Lake Drainage Cyprinid/Catostomid Stream*	--	--	--	X	X
Clear Lake Drainage Resident Trout Stream	*Clear Lake Drainage Resident Trout Stream*	--	--	--	X	
Clear Lake Drainage Seasonal Lakefish Spawning Stream	*Clear Lake Drainage Seasonal Lakefish Spawning Stream*	--	--	--	X	X
Coastal and Valley Freshwater Marsh	*Coastal and Valley Freshwater Marsh*	--	--	--		X
Great Valley Mixed Riparian Forest	*Great Valley Mixed Riparian Forest*	--	--	--		X
Northern Basalt Flow Vernal Pool	*Northern Basalt Flow Vernal Pool*	--	--	--	X	
Northern Interior Cypress Forest	*Northern Interior Cypress Forest*	--	--	--	X	
Northern Volcanic Ash Vernal Pool	*Northern Volcanic Ash Vernal Pool*	--	--	--	X	
Serpentine Bunchgrass	*Serpentine Bunchgrass*	--	--	--	X	
Upland Douglas Fir Forest	*Upland Douglas Fir Forest*	--	--	--	X	
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--	X	
Wildflower Field	*Wildflower Field*	--	--	--	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest Ecological
[1] Status definitions:

Federal Endangered Species Act (FESA):
FE Endangered
FT Threatened
FPE Proposed Endangered
FPT Proposed Threatened
FC Candidate
FD Delisted

California Endangered Species Act (CESA):
CE Endangered
CT Threatened
CR Rare
CCE Candidate Endangered
CD Delisted

Other California Department of Fish and Game (DFG):
FP Fully Protected under the California Fish and Game Code
CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
California Rare Plant Rank (CRPR):
List 1A Plants Presumed Extinct in California
List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 4 Plants of Limited Distribution - A Watch List
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-10. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Northern California Interior Coast Ranges Section

Common Name	Scientific Name	Status[1] FESA	CESA	Other DFG	USFS Ecological Subsection: Tehama Terraces
Plants					
adobe-lily	*Fritillaria pluriflora*	--	--	1B.2	X
Ahart's dwarf rush	*Juncus leiospermus var. ahartii*	--	--	1B.2	X
Ahart's paronychia	*Paronychia ahartii*	--	--	1B.1	X
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	--	--	1B.1	X
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2	X
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	--	CE	1B.2	X
dwarf downingia	*Downingia pusilla*	--	--	2.2	X
Jepson's horkelia	*Horkelia daucifolia var. indicta*	--	--	1B.1	X
Jepson's milk-vetch	*Astragalus rattanii var. jepsonianus*	--	--	1B.2	X
legenere	*Legenere limosa*	--	--	1B.1	X
pink creamsacs	*Castilleja rubicundula ssp. rubicundula*	--	--	1B.2	X
pointed broom sedge	*Carex scoparia*	--	--	2.2	X
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	--	--	1B.1	X
silky cryptantha	*Cryptantha crinita*	--	--	1B.2	X
slender Orcutt grass	*Orcuttia tenuis*	FT	CE	1B.1	X
Stony Creek spurge	*Chamaesyce ocellata ssp. rattanii*	--	--	1B.2	X
Sulphur Creek brodiaea	*Brodiaea matsonii*	--	--	1B.1	X
white-stemmed clarkia	*Clarkia gracilis ssp. albicaulis*	--	--	1B.2	X
Wildlife					
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X
bank swallow	*Riparia riparia*	--	CT	--	X
burrowing owl	*Athene cunicularia*	--	--	CSC	X
chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	FT	CT	--	X
chinook salmon - Sacramento River winter-run ESU	*Oncorhynchus tshawytscha*	FE	CE	--	X
pallid bat	*Antrozous pallidus*	--	--	CSC	X
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--	X
spotted bat	*Euderma maculatum*	--	--	CSC	X
Swainson's hawk	*Buteo swainsoni*	--	CT	--	X
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	--	--	X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	--	--	X
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	--	--	X
western pond turtle	*Emys marmorata*	--	--	CSC	X
western red bat	*Lasiurus blossevillii*	--	--	CSC	X
western spadefoot	*Spea hammondii*	--	--	CSC	X
Natural Communities					
Great Valley Cottonwood Riparian Forest	*Great Valley Cottonwood Riparian Forest*	--	--	--	X
Great Valley Mixed Riparian Forest	*Great Valley Mixed Riparian Forest*	--	--	--	X
Great Valley Valley Oak Riparian Forest	*Great Valley Valley Oak Riparian Forest*	--	--	--	X
Great Valley Willow Scrub	*Great Valley Willow Scrub*	--	--	--	X
Northern Hardpan Vernal Pool	*Northern Hardpan Vernal Pool*	--	--	--	X
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest Ecological
[1] Status definitions:

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CE Endangered
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List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 4 Plants of Limited Distribution - A Watch List
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-11. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Sierra Nevada Section

Common Name	Scientific Name	Status1			USFS Ecological Subsection									
		FESA	CESA	Other DFG	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt
Plants														
Ahart's buckwheat	*Eriogonum umbellatum var. ahartii*	--	--	1B.2				X						
alder buckthorn	*Rhamnus alnifolia*	--	--	2.2					X		X			
alkali hymenoxys	*Hymenoxys lemmonii*	--	--	2.2							X			
alkali mariposa-lily	*Calochortus striatus*	--	--	1B.2		X								
alpine dusty maidens	*Chaenactis douglasii var. alpina*	--	--	2.3			X							
American manna grass	*Glyceria grandis*	--	--	2.3			X			X	X			
aromatic canyon gooseberry	*Ribes menziesii var. ixoderme*	--	--	1B.2								X		
Baja navarretia	*Navarretia peninsularis*	--	--	1B.2								X		
Bakersfield cactus	*Opuntia basilaris var. treleasei*	FE	CE	1B.1		X								
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2	X			X						
Blandow's bog moss	*Helodium blandowii*	--	--	2.3		X								
Bolander's bruchia	*Bruchia bolanderi*	--	--	2.2		X		X					X	
Booth's hairy evening-primrose	*Camissonia boothii ssp. intermedia*	--	--	2.3		X								
Brandegee's clarkia	*Clarkia biloba ssp. brandegeeae*	--	--	1B.2				X						X
Breedlove's buckwheat	*Eriogonum breedlovei var. breedlovei*	--	--	1B.2								X		
broad-keeled milk-vetch	*Astragalus platytropis*	--	--	2.2			X							
broad-nerved hump moss	*Meesia uliginosa*	--	--	2.2						X	X			
brownish beaked-rush	*Rhynchospora capitellata*	--	--	2.2				X	X					X
buttercup-leaf suksdorfia	*Hemieva ranunculifolia*	--	--	2					X				X	
buxbaumia moss	*Buxbaumia viridis*	--	--	2.2										X
calico monkeyflower	*Mimulus pictus*	--	--	1B.2		X						X		
California twisted spikerush	*Eleocharis torticulmis*	--	--	1B.3					X					
canescent draba	*Draba cana*	--	--	2.3		X								
Cantelow's lewisia	*Lewisia cantelovii*	--	--	1B.2				X	X					X
Caribou coffeeberry	*Frangula purshiana ssp. ultramafica*	--	--	1B.2					X					
Charlotte's phacelia	*Phacelia nashiana*	--	--	1B.2		X								
Clifton's eremogone	*Eremogone cliftonii*	--	--	1B.3				X					X	
closed-throated beardtongue	*Penstemon personatus*	--	--	1B.2				X	X				X	X
common moonwort	*Botrychium lunaria*	--	--	2.3							X		X	
Congdon's lewisia	*Lewisia congdonii*	--	CR	1B.3										X
Congdon's woolly sunflower	*Eriophyllum congdonii*	--	CR	1B.2										X
Constance's rock-cress	*Boechera constancei*	--	--	1B.1				X	X				X	
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	--	--	1B.1								X		
cream-flowered bladderwort	*Utricularia ochroleuca*	--	--	2.2			X							
creamy blazing star	*Mentzelia tridentata*	--	--	1B.3		X								
Cup Lake draba	*Draba asterophora var. macrocarpa*	--	--	1B.1			X							
cut-leaf checkerbloom	*Sidalcea multifida*	--	--	2.3		X	X							
cylindrical trichodon	*Trichodon cylindricus*	--	--	2.2										X
Davy's sedge	*Carex davyi*	--	--	1B.3	X		X			X	X		X	
Dedecker's clover	*Trifolium dedeckerae*	--	--	1B.3		X								
delicate bluecup	*Githopsis tenella*	--	--	1B.3								X		
Dog Valley ivesia	*Ivesia aperta var. canina*	--	--	1B.1							X			
Donner Pass buckwheat	*Eriogonum umbellatum var. torreyanum*	--	--	1B.2							X		X	
dwarf resin birch	*Betula glandulosa*	--	--	2.2					X					
elongate copper moss	*Mielichhoferia elongata*	--	--	2.2				X						X
English sundew	*Drosera anglica*	--	--	2.3					X		X			
Father Crowley's lupine	*Lupinus padre-crowleyi*	--	CR	1B.2		X								
Feather River stonecrop	*Sedum albomarginatum*	--	--	1B.2				X	X				X	
fell-fields claytonia	*Claytonia megarhiza*	--	--	2.3			X				X			
field ivesia	*Ivesia campestris*	--	--	1B.2		X								
finger rush	*Juncus digitatus*	--	--	1B.1										X
flat-leaved bladderwort	*Utricularia intermedia*	--	--	2.2					X					
Follett's monardella	*Monardella follettii*	--	--	1B.2					X					
foxtail thelypodium	*Thelypodium integrifolium ssp. complanatum*	--	--	2.2		X								
frog's-bit buttercup	*Ranunculus hydrocharoides*	--	--	2.1		X								
Galena Creek rock-cress	*Arabis rigidissima var. demota*	--	--	1B.2							X			
giant goldenrod	*Solidago gigantea*	--	--	2.2					X					
Gilman's goldenbush	*Ericameria gilmanii*	--	--	1B.3		X								
golden violet	*Viola purpurea ssp. aurea*	--	--	2.2		X								
Great Basin claytonia	*Claytonia umbellata*	--	--	2.3		X								
Great Basin onion	*Allium atrorubens var. atrorubens*	--	--	2.3		X								
green spleenwort	*Asplenium trichomanes-ramosum*	--	--	2.3									X	
green yellow sedge	*Carex viridula var. viridula*	--	--	2.3	X									
grey-leaved violet	*Viola pinetorum ssp. grisea*	--	--	1B.3		X								
hairy marsh hedge-nettle	*Stachys palustris ssp. pilosa*	--	--	2.3									X	
Hall's daisy	*Erigeron aequifolius*	--	--	1B.3		X								
Hall's meadow hawksbeard	*Crepis runcinata ssp. hallii*	--	--	2.1		X								
hot springs fimbristylis	*Fimbristylis thermalis*	--	--	2.2		X								
inundated bog-clubmoss	*Lycopodiella inundata*	--	--	2.2										X
Inyo blazing star	*Mentzelia inyoensis*	--	--	1B.3		X								
Inyo County star-tulip	*Calochortus excavatus*	--	--	1B.1		X								
Jack's wild buckwheat	*Eriogonum luteolum var. saltuarium*	--	--	1B.2		X							X	
Jepson's onion	*Allium jepsonii*	--	--	1B.2				X						
Kelso Creek monkeyflower	*Mimulus shevockii*	--	--	1B.2		X								
Kern buckwheat	*Eriogonum kennedyi var. pinicola*	--	--	1B.1								X		
Kern Plateau bird's-beak	*Cordylanthus eremicus ssp. kernensis*	--	--	1B.3		X						X		
Kern River evening-primrose	*Camissonia integrifolia*	--	--	1B.3		X								
Koch's cord moss	*Entosthodon kochii*	--	--	1B.3										X
Latimer's woodland-gilia	*Saltugilia latimeri*	--	--	1B.2		X								
Layne's ragwort	*Packera layneae*	FT	CR	1B.2				X						X
Lemmon's milk-vetch	*Astragalus lemmonii*	--	--	1B.2		X					X			
Lewis Rose's ragwort	*Packera eurycephala var. lewisrosei*	--	--	1B.2				X	X					
Liddon's sedge	*Carex petasata*	--	--	2.3		X								
little bulrush	*Trichophorum pumilum*	--	--	2.2		X								
long-petaled lewisia	*Lewisia longipetala*	--	--	1B.3			X				X		X	
Madera leptosiphon	*Leptosiphon serrulatus*	--	--	1B.2		X						X		
marble rockmat	*Petrophyton caespitosum ssp. acuminatum*	--	--	1B.3		X								
Mariposa clarkia	*Clarkia biloba ssp. australis*	--	--	1B.2	X									X
Mariposa lupine	*Lupinus citrinus var. deflexus*	--	CT	1B.2										X
marsh arrow-grass	*Triglochin palustris*	--	--	2.3		X								
marsh skullcap	*Scutellaria galericulata*	--	--	2.2					X	X	X		X	
marsh willowherb	*Epilobium palustre*	--	--	2.3			X							
Masonic Mountain jewel-flower	*Streptanthus oliganthus*	--	--	1B.2		X	X							
Mcgee Meadows lupine	*Lupinus magnificus var. hesperius*	--	--	1B.3		X								
Merced clarkia	*Clarkia lingulata*	--	CE	1B.1										X
Mildred's clarkia	*Clarkia mildrediae ssp. mildrediae*	--	--	1B.3				X	X					
mingan moonwort	*Botrychium minganense*	--	--	2.2							X			
minute pocket moss	*Fissidens pauperculus*	--	--	1B.2				X						

Table I-11. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Sierra Nevada Section

Common Name	Scientific Name	Status1			USFS Ecological Subsection									
		FESA	CESA	Other DFG	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt
Mojave tarplant	*Deinandra mohavensis*	--	CE	1B.3		X								
Mono Lake lupine	*Lupinus duranii*	--	--	1B.2		X								
Mono milk-vetch	*Astragalus monoensis*	--	CR	1B.2		X								
Mosquin's clarkia	*Clarkia mosquinii*	--	--	1B.1				X						
Mount Patterson senecio	*Senecio pattersonensis*	--	--	1B.3			X							
mountain bent grass	*Agrostis humilis*	--	--	2.3	X		X							
mud sedge	*Carex limosa*	--	--	2.2	X		X		X	X	X		X	
Muir's tarplant	*Carlquistia muirii*	--	--	1B.3		X								
Munro's desert mallow	*Sphaeralcea munroana*	--	--	2.2							X			
narrow-leaved cottonwood	*Populus angustifolia*	--	--	2.2		X								
Nevada daisy	*Erigeron eatonii var. nevadincola*	--	--	2.3							X			
Nine Mile Canyon phacelia	*Phacelia novenmillensis*	--	--	1B.2		X						X		
Nissenan manzanita	*Arctostaphylos nissenana*	--	--	1B.2	X									X
Norris' beard moss	*Didymodon norrisii*	--	--	2.2	X			X					X	
northern adder's-tongue	*Ophioglossum pusillum*	--	--	2.2									X	
northern clustered sedge	*Carex arcta*	--	--	2.2										X
northern meadow sedge	*Carex praticola*	--	--	2.2							X			
Nuttall's ribbon-leaved pondweed	*Potamogeton epihydrus*	--	--	2.2			X		X				X	
Onyx Peak bedstraw	*Galium angustifolium ssp. onycense*	--	--	1B.3		X								
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2.3										X
Owens Peak lomatium	*Lomatium shevockii*	--	--	1B.3		X								
Owens Valley checkerbloom	*Sidalcea covillei*	--	CE	1B.1		X								
pale-yellow layia	*Layia heterotricha*	--	--	1B.1								X		
Palmer's mariposa-lily	*Calochortus palmeri var. palmeri*	--	--	1B.2		X						X		
Parry's horkelia	*Horkelia parryi*	--	--	1B.2										X
Pilot Ridge fawn lily	*Erythronium taylorii*	--	--	1B.2										X
Pine Hill flannelbush	*Fremontodendron decumbens*	FE	CR	1B.2				X						X
pinyon rock-cress	*Boechera dispar*	--	--	2.3		X								
Pinzl's rock-cress	*Boechera pinzliae*	--	--	1B.3		X								
Piute cypress	*Hesperocyparis nevadensis*	--	--	1B.2								X		
Piute Mountains jewel-flower	*Streptanthus cordatus var. piutensis*	--	--	1B.2		X						X		
Piute Mountains navarretia	*Navarretia setiloba*	--	--	1B.1								X		
Pleasant Valley mariposa-lily	*Calochortus clavatus var. avius*	--	--	1B.2	X								X	X
Plumas ivesia	*Ivesia sericoleuca*	--	--	1B.2							X			
pointed broom sedge	*Carex scoparia*	--	--	2.2					X					
prairie wedge grass	*Sphenopholis obtusata*	--	--	2.2										X
Raven's milk-vetch	*Astragalus ravenii*	--	--	1B.3		X								
Red Hills soaproot	*Chlorogalum grandiflorum*	--	--	1B.2										X
Ripley's aliciella	*Aliciella ripleyi*	--	--	2.3		X								
Robbins' pondweed	*Potamogeton robbinsii*	--	--	2.3	X	X	X							
rose-flowered larkspur	*Delphinium purpusii*	--	--	1B.3		X						X		
rosette cushion cryptantha	*Cryptantha circumscissa var. rosulata*	--	--	1B.2		X								
round-leaved filaree	*California macrophylla*	--	--	1B.1								X		
sagebrush loeflingia	*Loeflingia squarrosa var. artemisiarum*	--	--	2.2								X		
San Bernardino aster	*Symphyotrichum defoliatum*	--	--	1B.2								X		
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2				X						
Santa Lucia dwarf rush	*Juncus luciensis*	--	--	1B.2							X		X	
saw-toothed lewisia	*Lewisia serrata*	--	--	1B.1	X								X	X
Scadden Flat checkerbloom	*Sidalcea stipularis*	--	CE	1B.1				X						X
scalloped moonwort	*Botrychium crenulatum*	--	--	2.2		X					X			
seep kobresia	*Kobresia myosuroides*	--	--	2.3		X								
shaggyhair lupine	*Lupinus spectabilis*	--	--	1B.2										X
Sharsmith's stickseed	*Hackelia sharsmithii*	--	--	2.3		X								
Sheldon's sedge	*Carex sheldonii*	--	--	2.2					X					X
Shevock's bristle moss	*Orthotrichum shevockii*	--	--	1B.3		X								
Shevock's copper moss	*Schizymenium shevockii*	--	--	1B.2										X
short-fruited willow	*Salix brachycarpa ssp. brachycarpa*	--	--	2.3		X								
short-leaved hulsea	*Hulsea brevifolia*	--	--	1B.2	X	X								X
Sierra blue grass	*Poa sierrae*	--	--	1B.3				X						X
Sierra draba	*Draba sierrae*	--	--	1B.3		X								
Sierra Valley ivesia	*Ivesia aperta var. aperta*	--	--	1B.2							X			
simple androsace	*Androsace occidentalis var. simplex*	--	--	2.3										X
slender silver moss	*Anomobryum julaceum*	--	--	2.2				X						
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2		X	X			X	X		X	
slender-stemmed monkeyflower	*Mimulus filicaulis*	--	--	1B.2	X									X
small-flowered fescue	*Festuca minutiflora*	--	--	2.3		X								
small-flowered grass-of-Parnassus	*Parnassia parviflora*	--	--	2.2		X								
Small's southern clarkia	*Clarkia australis*	--	--	1B.2	X									X
smooth saltbush	*Atriplex pusilla*	--	--	2		X								
snow willow	*Salix nivalis*	--	--	2.3		X								
Spanish Needle onion	*Allium shevockii*	--	--	1B.3		X						X		
Spjut's bristle moss	*Orthotrichum spjutii*	--	--	1B.3			X							
starved daisy	*Erigeron miser*	--	--	1B.3		X							X	
Stebbins' lomatium	*Lomatium stebbinsii*	--	--	1B.1	X								X	X
Stebbins' monardella	*Monardella stebbinsii*	--	--	1B.2					X					
Stebbins' morning-glory	*Calystegia stebbinsii*	FE	CE	1B.1				X						
Stebbins' phacelia	*Phacelia stebbinsii*	--	--	1B.2	X								X	X
sticky pyrrocoma	*Pyrrocoma lucida*	--	--	1B.2					X					X
subalpine cryptantha	*Cryptantha crymophila*	--	--	1B.3		X	X						X	
sweet-smelling monardella	*Monardella beneolens*	--	--	1B.3		X								
Sweetwater Mountains draba	*Draba incrassata*	--	--	1B.3			X							
Tahoe draba	*Draba asterophora var. asterophora*	--	--	1B.2		X	X							
Tahoe yellow cress	*Rorippa subumbellata*	FC	CE	1B.1			X			X	X		X	
tall alpine-aster	*Oreostemma elatum*	--	--	1B.2					X				X	
tall draba	*Draba praealta*	--	--	2.3		X								
Tehachapi monardella	*Monardella linoides ssp. oblonga*	--	--	1B.3								X		
three-bracted onion	*Allium tribracteatum*	--	--	1B.2	X								X	X
Tioga Pass sedge	*Carex tiogana*	--	--	1B.3		X								
Tompkins' sedge	*Carex tompkinsii*	--	CR	4.3										X
Tracy's eriastrum	*Eriastrum tracyi*	--	CR	1B.2		X						X		
Tulare rockcress	*Boechera tularensis*	--	--	1B.3		X	X			X			X	
Tuolumne button-celery	*Eryngium pinnatisectum*	--	--	1B.2										X
Tuolumne fawn lily	*Erythronium tuolumnense*	--	--	1B.2	X									X
Tuolumne iris	*Iris hartwegii ssp. columbiana*	--	--	1B.2	X									X
upswept moonwort	*Botrychium ascendens*	--	--	2.3		X	X							
water bulrush	*Schoenoplectus subterminalis*	--	--	2.3			X			X			X	
watershield	*Brasenia schreberi*	--	--	2.3	X		X		X	X				
Webber's ivesia	*Ivesia webberi*	FC	--	1B.1					X		X		X	
Webber's milk-vetch	*Astragalus webberi*	--	--	1B.2					X					

Table I-11. Known Occurrences of Special-Status Species in Ecological Sections and Subsections														
Sierra Nevada Section														
		Status1			USFS Ecological Subsection									
Common Name	Scientific Name	FESA	CESA	Other DFG	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt
western goblin	*Botrychium montanum*	--	--	2.1									X	X
western single-spiked sedge	*Carex scirpoidea ssp. pseudoscirpoidea*	--	--	2.2		X	X							
western valley sedge	*Carex vallicola*	--	--	2.3		X	X							
white beaked-rush	*Rhynchospora alba*	--	--	2.2					X				X	
white-stemmed clarkia	*Clarkia gracilis ssp. albicaulis*	--	--	1B.2				X						
white-stemmed pondweed	*Potamogeton praelongus*	--	--	2.3									X	
woolly mountain-parsley	*Oreonana vestita*	--	--	1B.3		X								
woolly-fruited sedge	*Carex lasiocarpa*	--	--	2.3						X	X		X	
yellow willowherb	*Epilobium luteum*	--	--	2.3									X	
yellow-lip pansy monkeyflower	*Mimulus pulchellus*	--	--	1B.2	X									X
Yosemite bog orchid	*Platanthera yosemitensis*	--	--	1B.2										X
Yosemite lewisia	*Lewisia disepala*	--	--	1B.2		X								
Yosemite onion	*Allium yosemitense*	--	CR	1B.3										X
Yosemite woolly sunflower	*Eriophyllum nubigenum*	--	--	1B.3										X
Wildlife														
American badger	*Taxidea taxus*	--	--	CSC		X	X		X	X	X	X		
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP	X		X						X	
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X	X		X	X	X	X		X	
bank swallow	*Riparia riparia*	--	CT	--					X	X				
Bendire's thrasher	*Toxostoma bendirei*	--	--	CSC		X						X		
black swift	*Cypseloides niger*	--	--	CSC		X		X					X	X
Breckenridge Mountain slender salamander	*Batrachoseps sp. 1*	--	--	CSC								X		
burrowing owl	*Athene cunicularia*	--	--	CSC		X								
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP				X						X
California condor	*Gymnogyps californianus*	FE	CE	--		X						X		
California red-legged frog	*Rana draytonii*	FT	--	CSC	X			X						X
California spotted owl	*Strix occidentalis occidentalis*	--	--	CSC	X	X	X	X	X	X	X	X	X	X
California wolverine	*Gulo gulo*	FC	CT	FP	X	X	X		X		X		X	X
Cascades frog	*Rana cascadae*	--	--	CSC				X	X					
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC				X				X		X
desert tortoise	*Gopherus agassizii*	FT	CT	--		X								
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X			X	X				X	X
golden eagle	*Aquila chrysaetos*	--	--	FP								X	X	
gray vireo	*Vireo vicinior*	--	--	CSC		X								
great gray owl	*Strix nebulosa*	--	CE	--	X	X	X						X	X
greater sandhill crane	*Grus canadensis tabida*	--	CT	FP					X		X		X	
hardhead	*Mylopharodon conocephalus*	--	--	CSC				X	X					
harlequin duck	*Histrionicus histrionicus*	--	--	CSC									X	
Kern primrose sphinx moth	*Euproserpinus euterpe*	FT	--	--								X		
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	FT	--	--	X	X	X			X	X		X	X
Le Conte's thrasher	*Toxostoma lecontei*	--	--	CSC		X								
limestone salamander	*Hydromantes brunus*	--	CT	FP										X
long-eared owl	*Asio otus*	--	--	CSC		X								
Mohave ground squirrel	*Xerospermophilus mohavensis*	--	CT	--		X								
Mount Lyell salamander	*Hydromantes platycephalus*	--	--	CSC		X	X						X	
Mount Lyell shrew	*Sorex lyelli*	--	--	CSC		X								
northern goshawk	*Accipiter gentilis*	--	--	CSC	X	X	X	X	X	X	X		X	X
northern leopard frog	*Lithobates pipiens*	--	--	CSC		X	X			X	X			
Owens pupfish	*Cyprinodon radiosus*	FE	CE	FP		X								
Owens speckled dace	*Rhinichthys osculus ssp. 2*	--	--	CSC		X								
Owens sucker	*Catostomus fumeiventris*	--	--	CSC		X								
Owens tui chub	*Siphateles bicolor snyderi*	FE	CE	--		X								
Owens Valley vole	*Microtus californicus vallicola*	--	--	CSC		X								
Owens Valley web-toed salamander (AKA Oak Creek salamander)	*Hydromantes sp. 1*	--	--	CSC		X								
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	--	CSC	X	X	X	X	X	X	X	X	X	X
Paiute cutthroat trout	*Oncorhynchus clarkii seleniris*	FT	--	--		X	X							
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X		X	X		X		X	X
Panamint alligator lizard	*Elgaria panamintina*	--	--	CSC		X								
San Joaquin kit fox	*Vulpes macrotis mutica*	FE	CT	--								X		
San Joaquin roach	*Lavinia symmetricus ssp. 1*	--	--	CSC										X
Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*	FE	CE	FP		X								
Sierra Nevada mountain beaver	*Aplodontia rufa californica*	--	--	CSC		X					X		X	X
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--	X	X	X		X		X		X	X
Sierra Nevada snowshoe hare	*Lepus americanus tahoensis*	--	--	CSC	X		X			X	X		X	
Sierra Nevada yellow-legged frog	*Rana sierrae*	FC	CCE	CSC	X	X	X	X	X	X	X		X	X
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC		X								
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	CE	--		X						X		
spotted bat	*Euderma maculatum*	--	--	CSC	X	X					X			X
summer tanager	*Piranga rubra*	--	--	CSC		X								
Swainson's hawk	*Buteo swainsoni*	--	CT	--		X								
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	--	--	CSC		X						X		
Tehachapi slender salamander	*Batrachoseps stebbinsi*	--	CT	--								X		
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X	X			X			X		X
tricolored blackbird	*Agelaius tricolor*	--	--	CSC		X						X		X
Tulare grasshopper mouse	*Onychomys torridus tularensis*	--	--	CSC		X								
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	--	--				X				X		X
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X	X								X
western pond turtle	*Emys marmorata*	--	--	CSC	X	X		X						X
western red bat	*Lasiurus blossevillii*	--	--	CSC	X			X						X
western white-tailed jackrabbit	*Lepus townsendii townsendii*	--	--	CSC		X	X			X	X			
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--		X								
willow flycatcher	*Empidonax traillii*	--	CE	--	X	X	X		X	X	X		X	
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC		X					X		X	
yellow-blotched salamander	*Ensatina eschscholtzii croceator*	--	--	CSC								X		
yellow-breasted chat	*Icteria virens*	--	--	CSC		X								
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	--	--	CSC						X				
Yosemite toad	*Anaxyrus canorus*	FC	--	CSC		X	X							
Natural Communities														
Big Tree Forest	*Big Tree Forest*	--	--	--	X									X
Central Valley Drainage Hardhead/Squawfish Stream	*Central Valley Drainage Hardhead/Squawfish Stream*	--	--	--		X								X
Central Valley Drainage Resident Rainbow Trout Stream	*Central Valley Drainage Resident Rainbow Trout Stream*	--	--	--	X								X	X
Central Valley Drainage Spring Stream	*Central Valley Drainage Spring Stream*	--	--	--	X									X
Darlingtonia Seep	*Darlingtonia Seep*	--	--	--					X				X	X

Table I-11. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Sierra Nevada Section

Common Name	Scientific Name	Status1			USFS Ecological Subsection									
		FESA	CESA	Other DFG	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt
Fen	*Fen*	--	--	--							X		X	X
Great Basin Cutthroat Trout/Paiute Sculpin Stream	*Great Basin Cutthroat Trout/Paiute Sculpin Stream*	--	--	--							X		X	
Great Basin Sucker/Dace/Redside Stream With Cutthroat Trout	*Great Basin Sucker/Dace/Redside Stream With Cutthroat Trout*	--	--	--							X			
Great Valley Cottonwood Riparian Forest	*Great Valley Cottonwood Riparian Forest*	--	--	--		X								
Sacramento-San Joaquin Foothill/Valley Ephemeral Stream	*Sacramento-San Joaquin Foothill/Valley Ephemeral Stream*	--	--	--										X
Southern Interior Cypress Forest	*Southern Interior Cypress Forest*	--	--	--								X		
Sphagnum Bog	*Sphagnum Bog*	--	--	--			X			X				X
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--		X								
Water Birch Riparian Scrub	*Water Birch Riparian Scrub*	--	--	--		X								

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):
FE Endangered
FT Threatened
FPE Proposed Endangered
FPT Proposed Threatened
FC Candidate
FD Delisted

California Endangered Species Act (CESA):
CE Endangered
CT Threatened
CR Rare
CCE Candidate Endangered
CD Delisted

Other California Department of Fish and Game (DFG):
FP Fully Protected under the California Fish and Game Code
CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
California Rare Plant Rank (CRPR):
List 1A Plants Presumed Extinct in California
List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 4 Plants of Limited Distribution - A Watch List
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-12. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Sierra Nevada Foothills Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection		
		FESA	CESA	Other DFG	Lower Foothills Metamorphic Belt	Lower Granitic Foothills	San Emigdio Mountains
Plants							
Ahart's buckwheat	*Eriogonum umbellatum var. ahartii*	--	--	1B.2	X		
American manna grass	*Glyceria grandis*	--	--	2.3		X	
aromatic canyon gooseberry	*Ribes menziesii var. ixoderme*	--	--	1B.2		X	
beaked clarkia	*Clarkia rostrata*	--	--	1B.3	X	X	
big-scale balsamroot	*Balsamorhiza macrolepis var. macrolepis*	--	--	1B.2	X	X	
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	--	CE	1B.2		X	
Brandegee's clarkia	*Clarkia biloba ssp. brandegeeae*	--	--	1B.2	X		
Butte County checkerbloom	*Sidalcea robusta*	--	--	1B.2	X		
Butte County golden clover	*Trifolium jokerstii*	--	--	1B.2	X		
Butte County meadowfoam	*Limnanthes floccosa ssp. californica*	FE	CE	1B.1	X		
calico monkeyflower	*Mimulus pictus*	--	--	1B.2		X	
Chinese Camp brodiaea	*Brodiaea pallida*	FT	CE	1B.1	X		
Congdon's lomatium	*Lomatium congdonii*	--	--	1B.2	X		
delicate bluecup	*Githopsis tenella*	--	--	1B.3	X		X
Delta button-celery	*Eryngium racemosum*	--	CE	1B.1	X		
dwarf downingia	*Downingia pusilla*	--	--	2.2	X		
El Dorado bedstraw	*Galium californicum ssp. sierrae*	FE	CR	1B.2	X		
El Dorado County mule ears	*Wyethia reticulata*	--	--	1B.2	X		
elongate copper moss	*Mielichhoferia elongata*	--	--	2.2		X	
Fort Tejon woolly sunflower	*Eriophyllum lanatum var. hallii*	--	--	1B.1			X
Hartweg's golden sunburst	*Pseudobahia bahiifolia*	FE	CE	1B.1	X	X	
Hoover's calycadenia	*Calycadenia hooveri*	--	--	1B.3	X		
Horn's milk-vetch	*Astragalus hornii var. hornii*	--	--	1B.1			X
Ione manzanita	*Arctostaphylos myrtifolia*	FT	--	1B.2	X		
Jepson's onion	*Allium jepsonii*	--	--	1B.2	X		
Kaweah brodiaea	*Brodiaea insignis*	--	CE	1B.2		X	
Kaweah monkeyflower	*Mimulus norrisii*	--	--	1B.3		X	
Keck's checkerbloom	*Sidalcea keckii*	FE	--	1B.1		X	
Kings River buckwheat	*Eriogonum nudum var. regirivum*	--	--	1B.2		X	
knotted rush	*Juncus nodosus*	--	--	2.3		X	
Layne's ragwort	*Packera layneae*	FT	CR	1B.2	X		
Lemmon's jewel-flower	*Caulanthus lemmonii*	--	--	1B.2			X
Lewis Rose's ragwort	*Packera eurycephala var. lewisrosei*	--	--	1B.2	X		
Madera leptosiphon	*Leptosiphon serrulatus*	--	--	1B.2	X	X	X
Mariposa clarkia	*Clarkia biloba ssp. australis*	--	--	1B.2	X		
Mariposa cryptantha	*Cryptantha mariposae*	--	--	1B.3	X		
Mariposa lupine	*Lupinus citrinus var. deflexus*	--	CT	1B.2	X	X	
Mariposa pussypaws	*Calyptridium pulchellum*	FT	--	1B.1	X	X	
Merced phacelia	*Phacelia ciliata var. opaca*	--	--	1B.2	X		
Mosquin's clarkia	*Clarkia mosquinii*	--	--	1B.1	X		
mouse buckwheat	*Eriogonum nudum var. murinum*	--	--	1B.2		X	
Munz's iris	*Iris munzii*	--	--	1B.3		X	
Nissenan manzanita	*Arctostaphylos nissenana*	--	--	1B.2	X		
Onyx Peak bedstraw	*Galium angustifolium ssp. onycense*	--	--	1B.3		X	
orange lupine	*Lupinus citrinus var. citrinus*	--	--	1B.2		X	
oval-leaved viburnum	*Viburnum ellipticum*	--	--	2.3	X	X	
pale-yellow layia	*Layia heterotricha*	--	--	1B.1			X
Palmer's mariposa-lily	*Calochortus palmeri var. palmeri*	--	--	1B.2			X
Parry's horkelia	*Horkelia parryi*	--	--	1B.2	X		
Pine Hill ceanothus	*Ceanothus roderickii*	FE	CR	1B.2	X		
Pine Hill flannelbush	*Fremontodendron decumbens*	FE	CR	1B.2	X		
pink creamsacs	*Castilleja rubicundula ssp. rubicundula*	--	--	1B.2	X		
Piute Mountains navarretia	*Navarretia setiloba*	--	--	1B.1		X	X
Pleasant Valley mariposa-lily	*Calochortus clavatus var. avius*	--	--	1B.2	X		
prairie wedge grass	*Sphenopholis obtusata*	--	--	2.2	X		
Rawhide Hill onion	*Allium tuolumnense*	--	--	1B.2	X		
Rawson's flaming trumpet	*Collomia rawsoniana*	--	--	1B.2		X	
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	--	--	1B.1	X		
Red Hills ragwort	*Senecio clevelandii var. heterophyllus*	--	--	1B.2	X		
Red Hills soaproot	*Chlorogalum grandiflorum*	--	--	1B.2	X		
Red Hills vervain	*Verbena californica*	FT	CT	1B.1	X		
rose-flowered larkspur	*Delphinium purpusii*	--	--	1B.3		X	
round-leaved filaree	*California macrophylla*	--	--	1B.1			X
San Bernardino aster	*Symphyotrichum defoliatum*	--	--	1B.2			X
San Joaquin adobe sunburst	*Pseudobahia peirsonii*	FT	CE	1B.1		X	
San Joaquin Valley Orcutt grass	*Orcuttia inaequalis*	FT	CE	1B.1		X	
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2	X		
Scadden Flat checkerbloom	*Sidalcea stipularis*	--	CE	1B.1	X		
shaggyhair lupine	*Lupinus spectabilis*	--	--	1B.2	X		
Shevock's copper moss	*Schizymenium shevockii*	--	--	1B.2		X	
slender-stalked monkeyflower	*Mimulus gracilipes*	--	--	1B.2	X	X	
spiny-sepaled button-celery	*Eryngium spinosepalum*	--	--	1B.2	X	X	
Springville clarkia	*Clarkia springvillensis*	FT	CE	1B.2		X	
Stebbins' morning-glory	*Calystegia stebbinsii*	FE	CE	1B.1	X		
striped adobe-lily	*Fritillaria striata*	--	CT	1B.1		X	
succulent owl's-clover	*Castilleja campestris ssp. succulenta*	FT	CE	1B.2	X	X	
Tehachapi buckwheat	*Eriogonum callistum*	--	--	1B.1			X
Tejon poppy	*Eschscholzia lemmonii ssp. kernensis*	--	--	1B.1			X
tongue-leaf copper moss	*Scopelophila cataractae*	--	--	2.2	X		
tree-anemone	*Carpenteria californica*	--	CT	1B.2		X	
Tuolumne button-celery	*Eryngium pinnatisectum*	--	--	1B.2	X		
Tuolumne fawn lily	*Erythronium tuolumnense*	--	--	1B.2	X		
veiny monardella	*Monardella douglasii ssp. venosa*	--	--	1B.1	X		
white-stemmed clarkia	*Clarkia gracilis ssp. albicaulis*	--	--	1B.2	X		
yellow-lip pansy monkeyflower	*Mimulus pulchellus*	--	--	1B.2	X	X	
Yosemite bog orchid	*Platanthera yosemitensis*	--	--	1B.2		X	
Wildlife							
American badger	*Taxidea taxus*	--	--	CSC	X	X	X
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X	X	
black swift	*Cypseloides niger*	--	--	CSC		X	
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP	X		
California condor	*Gymnogyps californianus*	FE	CE	--		X	X
California red-legged frog	*Rana draytonii*	FT	--	CSC	X		
California spotted owl	*Strix occidentalis occidentalis*	--	--	CSC		X	X
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC	X	X	
California wolverine	*Gulo gulo*	FC	CT	FP		X	
chinook salmon - Central Valley spring-run ESU	*Oncorhynchus tshawytscha*	FT	CT	--	X		
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X		X
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	X	
golden eagle	*Aquila chrysaetos*	--	--	FP	X	X	X
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC	X		
great gray owl	*Strix nebulosa*	--	CE	--	X	X	
limestone salamander	*Hydromantes brunus*	--	CT	FP	X		
long-eared owl	*Asio otus*	--	--	CSC	X		
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	--	CSC	X	X	
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	X
Red Hills roach	*Lavinia symmetricus ssp. 3*	--	--	CSC	X		
San Joaquin kit fox	*Vulpes macrotis mutica*	FE	CT	--	X	X	
San Joaquin roach	*Lavinia symmetricus ssp. 1*	--	--	CSC	X		
Sierra Madre yellow-legged frog	*Rana muscosa*	FE	CCE	CSC		X	

Table I-12. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Sierra Nevada Foothills Section

Common Name	Scientific Name	Status[1] FESA	CESA	Other DFG	USFS Ecological Subsection: Lower Foothills Metamorphic Belt	Lower Granitic Foothills	San Emigdio Mountains
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--		X	
spotted bat	*Euderma maculatum*	--	--	CSC		X	
Swainson's hawk	*Buteo swainsoni*	--	CT	--	X	X	
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	--	--	CSC			X
Tehachapi slender salamander	*Batrachoseps stebbinsi*	--	CT	--			X
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X		
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X	X
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT	--	--	X	X	
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	--	--	X	X	
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	--	--	X	X	
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X	X	
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC	X		
western spadefoot	*Spea hammondii*	--	--	CSC	X	X	
white-tailed kite	*Elanus leucurus*	--	--	FP	X		
willow flycatcher	*Empidonax traillii*	--	CE	--		X	
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC	X		
yellow-blotched salamander	*Ensatina eschscholtzii croceator*	--	--	CSC			X
Natural Communities							
Central Valley Drainage Hardhead/Squawfish Stream	*Central Valley Drainage Hardhead/Squawfish Stream*	--	--	--	X	X	
Central Valley Drainage Rainbow Trout/Cyprinid Stream	*Central Valley Drainage Rainbow Trout/Cyprinid Stream*	--	--	--		X	
Central Valley Drainage Resident Rainbow Trout Stream	*Central Valley Drainage Resident Rainbow Trout Stream*	--	--	--		X	
Great Valley Mixed Riparian Forest	*Great Valley Mixed Riparian Forest*	--	--	--		X	
Great Valley Willow Scrub	*Great Valley Willow Scrub*	--	--	--	X		
Ione Chaparral	*Ione Chaparral*	--	--	--	X		
Northern Basalt Flow Vernal Pool	*Northern Basalt Flow Vernal Pool*	--	--	--	X	X	
Northern Claypan Vernal Pool	*Northern Claypan Vernal Pool*	--	--	--		X	
Northern Hardpan Vernal Pool	*Northern Hardpan Vernal Pool*	--	--	--	X	X	
Northern Volcanic Mud Flow Vernal Pool	*Northern Volcanic Mud Flow Vernal Pool*	--	--	--	X		
Southern Cottonwood Willow Riparian Forest	*Southern Cottonwood Willow Riparian Forest*	--	--	--			X
Sycamore Alluvial Woodland	*Sycamore Alluvial Woodland*	--	--	--		X	
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--			X
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--			X
Wildflower Field	*Wildflower Field*	--	--	--			X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest Ecological
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-13. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Sonoran Desert Section

Common Name	Scientific Name	Status[1] FESA	CESA	Other DFG	USFS Ecological Subsection: Chocolate Mountains and Valleys	Gila Bend Plain Desert Shrubland
Plants						
bitter hymenoxys	*Hymenoxys odorata*	--	--	2	X	X
California ayenia	*Ayenia compacta*	--	--	2.3	X	
Cove's cassia	*Senna covesii*	--	--	2.2	X	
Darlington's blazing star	*Mentzelia puberula*	--	--	2.2	X	
Deep Canyon snapdragon	*Antirrhinum cyathiferum*	--	--	2.3	X	
desert pincushion	*Coryphantha chlorantha*	--	--	2.1		X
desert sand-parsley	*Ammoselinum giganteum*	--	--	2.3	X	
desert spike-moss	*Selaginella eremophila*	--	--	2.2	X	
dwarf germander	*Teucrium cubense ssp. depressum*	--	--	2.2	X	
Emory's crucifixion-thorn	*Castela emoryi*	--	--	2.3	X	X
glandular ditaxis	*Ditaxis claryana*	--	--	2.2	X	X
Harwood's milk-vetch	*Astragalus insularis var. harwoodii*	--	--	2.2	X	
Las Animas colubrina	*Colubrina californica*	--	--	2.3	X	
Munz's cholla	*Cylindropuntia munzii*	--	--	1B.3	X	
Orocopia sage	*Salvia greatae*	--	--	1B.3	X	
pink fairy-duster	*Calliandra eriophylla*	--	--	2.3	X	
saguaro	*Carnegiea gigantea*	--	--	2.2	X	
sand evening-primrose	*Camissonia arenaria*	--	--	2.2	X	X
slender-spined all-thorn	*Koeberlinia spinosa ssp. tenuispina*	--	--	2.2	X	
spear-leaf matelea	*Matelea parvifolia*	--	--	2.3	X	
triple-ribbed milk-vetch	*Astragalus tricarinatus*	FE	--	1B.2	X	
Wildlife						
American badger	*Taxidea taxus*	--	--	CSC	X	X
Arizona bell's vireo	*Vireo bellii arizonae*	--	CE	--	X	X
banded gila monster	*Heloderma suspectum cinctum*	--	--	CSC	X	
Bendire's thrasher	*Toxostoma bendirei*	--	--	CSC	X	
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP	X	X
California leaf-nosed bat	*Macrotus californicus*	--	--	CSC	X	
cave myotis	*Myotis velifer*	--	--	CSC	X	X
Colorado pikeminnow	*Ptychocheilus lucius*	FE	CE	FP	X	
Colorado River cotton rat	*Sigmodon arizonae plenus*	--	--	CSC	X	X
Couch's spadefoot	*Scaphiopus couchii*	--	--	CSC	X	
Crissal thrasher	*Toxostoma crissale*	--	--	CSC	X	X
desert pupfish	*Cyprinodon macularius*	FE	CE	--	X	
desert tortoise	*Gopherus agassizii*	FT	CT	--	X	
elf owl	*Micrathene whitneyi*	--	CE	--	X	
Gila woodpecker	*Melanerpes uropygialis*	--	CE	--	X	X
gilded flicker	*Colaptes chrysoides*	--	CE	--	X	
Le Conte's thrasher	*Toxostoma lecontei*	--	--	CSC	X	
least bittern	*Ixobrychus exilis*	--	--	CSC	X	X
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC	X	
lowland (=Yavapai, San Sebastian & San Felipe) leopard frog	*Lithobates yavapaiensis*	--	--	CSC	X	
Lucy's warbler	*Oreothlypis luciae*	--	--	CSC	X	
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X
pallid San Diego pocket mouse	*Chaetodipus fallax pallidus*	--	--	CSC	X	
Palm Springs pocket mouse	*Perognathus longimembris bangsi*	--	--	CSC	X	
pocketed free-tailed bat	*Nyctinomops femorosaccus*	--	--	CSC	X	
razorback sucker	*Xyrauchen texanus*	FE	CE	FP	X	X
Sonoran yellow warbler	*Dendroica petechia sonorana*	--	--	CSC	X	
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	CE	--	X	
summer tanager	*Piranga rubra*	--	--	CSC	X	X
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X	
vermilion flycatcher	*Pyrocephalus rubinus*	--	--	CSC	X	X
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X	X
western yellow bat	*Lasiurus xanthinus*	--	--	CSC	X	
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--	X	X
yellow-breasted chat	*Icteria virens*	--	--	CSC	X	X
Yuma clapper rail	*Rallus longirostris yumanensis*	FE	CT	FP	X	X
Yuma hispid cotton rat	*Sigmodon hispidus eremicus*	--	--	CSC	X	
Yuma mountain lion	*Puma concolor browni*	--	--	CSC	X	X
Natural Communities						
Desert Fan Palm Oasis Woodland	*Desert Fan Palm Oasis Woodland*	--	--	--	X	
Sonoran Cottonwood Willow Riparian Forest	*Sonoran Cottonwood Willow Riparian Forest*	--	--	--	X	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
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CR Rare
CCE Candidate Endangered
CD Delisted

Other California Department of Fish and Game (DFG):
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List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 4 Plants of Limited Distribution - A Watch List
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-14. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains
Plants												
Agoura Hills dudleya	*Dudleya cymosa ssp. agourensis*	FT	--	1B.2					X			X
Allen's pentachaeta	*Pentachaeta aurea ssp. allenii*	--	--	1B.1	X	X	X					
aphanisma	*Aphanisma blitoides*	--	--	1B.2		X	X			X	X	
Baja California birdbush	*Ornithostaphylos oppositifolia*	--	CE	2.1		X						
beach goldenaster	*Heterotheca sessiliflora ssp. sessiliflora*	--	--	1B.1		X						
beach layia	*Layia carnosa*	FE	CE	1B.1							X	
beach spectaclepod	*Dithyrea maritima*	--	CT	1B.1			X			X	X	
big-leaved crownbeard	*Verbesina dissita*	FT	CT	1B.1	X	X						
black-flowered figwort	*Scrophularia atrata*	--	--	1B.2						X	X	
Blochman's dudleya	*Dudleya blochmaniae ssp. blochmaniae*	--	--	1B.1	X	X	X		X	X		X
Blochman's leafy daisy	*Erigeron blochmaniae*	--	--	1B.2						X	X	
Bolander's water-hemlock	*Cicuta maculata var. bolanderi*	--	--	2.1						X		
bottle liverwort	*Sphaerocarpos drewei*	--	--	1B.1		X						
Brand's star phacelia	*Phacelia stellaris*	FC	--	1B.1		X	X					
Braunton's milk-vetch	*Astragalus brauntonii*	FE	--	1B.1	X		X		X			X
California adolphia	*Adolphia californica*	--	--	2.1	X	X						
California beardtongue	*Penstemon californicus*	--	--	1B.2	X							
California Orcutt grass	*Orcuttia californica*	FE	CE	1B.1		X	X		X			X
California satintail	*Imperata brevifolia*	--	--	2.1	X							
California saw-grass	*Cladium californicum*	--	--	2.2			X			X		
Campbell's liverwort	*Geothallus tuberosus*	--	--	1B.1	X	X						
Catalina crossosoma	*Crossosoma californicum*	--	--	1B.2			X					
Cedros Island oak	*Quercus cedrosensis*	--	--	2.2	X							
chaparral nolina	*Nolina cismontana*	--	--	1B.2	X		X				X	X
chaparral ragwort	*Senecio aphanactis*	--	--	2.2	X	X	X	X	X		X	X
chaparral sand-verbena	*Abronia villosa var. aurita*	--	--	1B.1	X		X					
cliff spurge	*Euphorbia misera*	--	--	2.2	X	X	X					
coast woolly-heads	*Nemacaulis denudata var. denudata*	--	--	1B.2		X	X					
coastal dunes milk-vetch	*Astragalus tener var. titi*	FE	CE	1B.1		X	X					
coastal goosefoot	*Chenopodium littoreum*	--	--	1B.2			X			X	X	
coastal triquetrella	*Triquetrella californica*	--	--	1B.2	X							
conejo buckwheat	*Eriogonum crocatum*	--	CR	1B.2				X	X			X
Conejo dudleya	*Dudleya parva*	FT	--	1B.2				X				X
Contra Costa goldfields	*Lasthenia conjugens*	FE	--	1B.1							X	
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	--	--	1B.1	X	X	X	X	X	X	X	
Coulter's saltbush	*Atriplex coulteri*	--	--	1B.2	X	X	X		X		X	
crisp monardella	*Monardella crispa*	--	--	1B.2						X	X	
Davidson's bush-mallow	*Malacothamnus davidsonii*	--	--	1B.2			X					X
Davidson's saltscale	*Atriplex serenana var. davidsonii*	--	--	1B.2	X	X	X			X	X	
Dean's milk-vetch	*Astragalus deanei*	--	--	1B.1	X	X						
decumbent goldenbush	*Isocoma menziesii var. decumbens*	--	--	1B.2	X	X						
Dehesa nolina	*Nolina interrata*	--	CE	1B.1	X							
Del Mar manzanita	*Arctostaphylos glandulosa ssp. crassifolia*	FE	--	1B.1	X	X						
Del Mar Mesa sand aster	*Corethrogyne filaginifolia var. linifolia*	--	--	1B.1	X	X						
delicate clarkia	*Clarkia delicata*	--	--	1B.2	X							
desert bedstraw	*Galium proliferum*	--	--	2.2	X	X						
dune larkspur	*Delphinium parryi ssp. blochmaniae*	--	--	1B.2					X	X	X	X
Dunn's mariposa-lily	*Calochortus dunnii*	--	CR	1B.2	X							
dwarf calycadenia	*Calycadenia villosa*	--	--	1B.1						X		
Eastwood's brittle-leaf manzanita	*Arctostaphylos crustacea ssp. eastwoodiana*	--	--	1B.1							X	
Encinitas baccharis	*Baccharis vanessae*	FT	CE	1B.1	X	X						
estuary seablite	*Suaeda esteroa*	--	--	1B.2	X	X	X	X	X		X	
felt-leaved monardella	*Monardella hypoleuca ssp. lanata*	--	--	1B.2	X							
Gambel's water cress	*Nasturtium gambelii*	FE	CT	1B.1			X			X	X	
Gander's pitcher sage	*Lepechinia ganderi*	--	--	1B.3	X							
Gander's ragwort	*Packera ganderi*	--	CR	1B.2	X							
Gaviota tarplant	*Deinandra increscens ssp. villosa*	FE	CE	1B.1						X	X	
golden-spined cereus	*Bergerocactus emoryi*	--	--	2.2	X	X						
Greata's aster	*Symphyotrichum greatae*	--	--	1B.3			X					
heart-leaved pitcher sage	*Lepechinia cardiophylla*	--	--	1B.2	X							
Hoover's bent grass	*Agrostis hooveri*	--	--	1B.2						X		
intermediate mariposa-lily	*Calochortus weedii var. intermedius*	--	--	1B.2	X	X	X					
island green dudleya	*Dudleya virens ssp. insularis*	--	--	1B.2			X					
Jennifer's monardella	*Monardella stoneana*	--	--	1B.2	X							
Kellogg's horkelia	*Horkelia cuneata ssp. sericea*	--	--	1B.1						X	X	
La Graciosa thistle	*Cirsium scariosum var. loncholepis*	FE	CT	1B.1						X	X	
La Purisima manzanita	*Arctostaphylos purissima*	--	--	1B.1						X	X	
La Purisima viguiera	*Viguiera purisimae*	--	--	2.3	X							
Laguna Beach dudleya	*Dudleya stolonifera*	FT	CT	1B.1	X	X						
Lakeside ceanothus	*Ceanothus cyaneus*	--	--	1B.2	X	X						
late-flowered mariposa-lily	*Calochortus fimbriatus*	--	--	1B.2						X	X	X
lemon lily	*Lilium parryi*	--	--	1B.2	X		X					
Lompoc yerba santa	*Eriodictyon capitatum*	FE	CR	1B.2						X	X	
long-spined spineflower	*Chorizanthe polygonoides var. longispina*	--	--	1B.2	X	X	X					
Lyon's pentachaeta	*Pentachaeta lyonii*	FE	CE	1B.1			X		X			X
Malibu baccharis	*Baccharis malibuensis*	--	--	1B.1	X				X			
many-stemmed dudleya	*Dudleya multicaulis*	--	--	1B.2	X	X	X		X			
marcescent dudleya	*Dudleya cymosa ssp. marcescens*	FT	CR	1B.2					X			
marsh sandwort	*Arenaria paludicola*	FE	CE	1B.1			X					
mesa horkelia	*Horkelia cuneata ssp. puberula*	--	--	1B.1	X	X	X		X	X	X	
Mexican flannelbush	*Fremontodendron mexicanum*	FE	CR	1B.1	X	X						
Miles' milk-vetch	*Astragalus didymocarpus var. milesianus*	--	--	1B.2						X	X	
Moreno currant	*Ribes canthariforme*	--	--	1B.3	X							
mud nama	*Nama stenocarpum*	--	--	2.2	X	X	X					
Munz's sage	*Salvia munzii*	--	--	2.2	X	X						
Nevin's barberry	*Berberis nevinii*	FE	CE	1B.1		X	X		X			
Norris' beard moss	*Didymodon norrisii*	--	--	2.2					X			
Nuttall's lotus	*Lotus nuttallianus*	--	--	1B.1		X						
Nuttall's lotus**	*Lotus nuttallianus*	--	--	1B.1		X						
Nuttall's scrub oak	*Quercus dumosa*	--	--	1B.1	X	X	X				X	
oil neststraw	*Stylocline citroleum*	--	--	1B.1	X	X						
Ojai fritillary	*Fritillaria ojaiensis*	--	--	1B.2							X	
Ojai navarretia	*Navarretia ojaiensis*	--	--	1B.1					X		X	X
Orcutt's bird's-beak	*Dicranostegia orcuttiana*	--	--	2.1	X	X						
Orcutt's brodiaea	*Brodiaea orcuttii*	--	--	1B.1	X	X						
Orcutt's dudleya	*Dudleya attenuata ssp. orcuttii*	--	--	2.1		X						
Orcutt's hazardia	*Hazardia orcuttii*	FC	CT	1B.1		X						
Orcutt's pincushion	*Chaenactis glabriuscula var. orcuttiana*	--	--	1B.1	X	X	X	X	X			
Orcutt's spineflower	*Chorizanthe orcuttiana*	FE	CE	1B.1	X	X						
Otay manzanita	*Arctostaphylos otayensis*	--	--	1B.2	X							
Otay Mesa mint	*Pogogyne nudiuscula*	FE	CE	1B.1	X	X						
Otay Mountain ceanothus	*Ceanothus otayensis*	--	--	1B.2	X							
Otay tarplant	*Deinandra conjugens*	FT	CE	1B.1	X	X						
pale-yellow layia	*Layia heterotricha*	--	--	1B.1						X	X	
Palmer's frankenia	*Frankenia palmeri*	--	--	2.1		X						
Palmer's goldenbush	*Ericameria palmeri var. palmeri*	--	--	1B.1	X	X						
Parish's brittlescale	*Atriplex parishii*	--	--	1B.1	X	X	X		X			
Parry's spineflower	*Chorizanthe parryi var. parryi*	--	--	1B.1			X		X			
Parry's tetracoccus	*Tetracoccus dioicus*	--	--	1B.2	X	X						
Pendleton button-celery	*Eryngium pendletonense*	--	--	1B.1		X						

Table I-14. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains
Peruvian dodder	*Cuscuta obtusiflora var. glandulosa*	--	--	2.2			X					
Plummer's mariposa-lily	*Calochortus plummerae*	--	--	1B.2	X		X	X	X		X	X
prostrate vernal pool navarretia	*Navarretia prostrata*	--	--	1B.1	X	X	X					
purple stemodia	*Stemodia durantifolia*	--	--	2.1	X	X						
Rainbow manzanita	*Arctostaphylos rainbowensis*	--	--	1B.1	X							
Ramona horkelia	*Horkelia truncata*	--	--	1B.3	X							
Refugio manzanita	*Arctostaphylos refugioensis*	--	--	1B.2							X	
Robinson's pepper-grass	*Lepidium virginicum var. robinsonii*	--	--	1B.2	X	X	X					
round-leaved filaree	*California macrophylla*	--	--	1B.1	X	X	X		X	X		X
salt marsh bird's-beak	*Chloropyron maritimum ssp. maritimum*	FE	CE	1B.2		X	X	X	X		X	
Salt Spring checkerbloom	*Sidalcea neomexicana*	--	--	2.2	X		X				X	
San Bernardino aster	*Symphyotrichum defoliatum*	--	--	1B.2			X		X			
San Diego ambrosia	*Ambrosia pumila*	FE	--	1B.1	X	X						
San Diego barrel cactus	*Ferocactus viridescens*	--	--	2.1	X	X						
San Diego bur-sage	*Ambrosia chenopodiifolia*	--	--	2.1		X						
San Diego button-celery	*Eryngium aristulatum var. parishii*	FE	CE	1B.1	X	X						
San Diego goldenstar	*Bloomeria clevelandii*	--	--	1B.1	X	X						
San Diego marsh-elder	*Iva hayesiana*	--	--	2.2	X	X						
San Diego mesa mint	*Pogogyne abramsii*	FE	CE	1B.1	X	X						
San Diego milk-vetch	*Astragalus oocarpus*	--	--	1B.2	X							
San Diego sand aster	*Corethrogyne filaginifolia var. incana*	--	--	1B.1		X						
San Diego thorn-mint	*Acanthomintha ilicifolia*	FT	CE	1B.1	X	X						
San Fernando Valley spineflower	*Chorizanthe parryi var. fernandina*	FC	CE	1B.1	X		X					X
San Gabriel bedstraw	*Galium grande*	--	--	1B.2			X					
San Luis Obispo monardella	*Monardella frutescens*	--	--	1B.2						X	X	
San Miguel savory	*Satureja chandleri*	--	--	1B.2	X							
sand mesa manzanita	*Arctostaphylos rudis*	--	--	1B.2						X	X	
sand-loving wallflower	*Erysimum ammophilum*	--	--	1B.2	X	X						
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2			X				X	
Santa Ana River woollystar	*Eriastrum densifolium ssp. sanctorum*	FE	CE	1B.1	X		X					
Santa Barbara honeysuckle	*Lonicera subspicata var. subspicata*	--	--	1B.2						X	X	
Santa Barbara jewel-flower	*Caulanthus amplexicaulis var. barbarae*	--	--	1B.1						X		
Santa Catalina Island currant	*Ribes viburnifolium*	--	--	1B.2		X						
Santa Catalina Island desert-thorn	*Lycium brevipes var. hassei*	--	--	1B.1			X					
Santa Lucia dwarf rush	*Juncus luciensis*	--	--	1B.2							X	
Santa Monica dudleya	*Dudleya cymosa ssp. ovatifolia*	FT	--	1B.2	X				X			
Santa Susana tarplant	*Deinandra minthornii*	--	CR	1B.2			X		X			X
Santa Ynez false lupine	*Thermopsis macrophylla*	--	CR	1B.3							X	
Santa Ynez groundstar	*Ancistrocarphus keilii*	--	--	1B.1						X	X	
sea dahlia	*Leptosyne maritima*	--	--	2.2	X	X						
seaside bird's-beak	*Cordylanthus rigidus ssp. littoralis*	--	CE	1B.1						X	X	
Shaw's agave	*Agave shawii*	--	--	2.1		X						
short-leaved dudleya	*Dudleya brevifolia*	--	CE	1B.1		X						
singlewhorl burrobrush	*Ambrosia monogyra*	--	--	2.2	X	X						
slender cottonheads	*Nemacaulis denudata var. gracilis*	--	--	2.2		X						
slender mariposa-lily	*Calochortus clavatus var. gracilis*	--	--	1B.2			X		X			X
slender silver moss	*Anomobryum julaceum*	--	--	2.2							X	
slender-horned spineflower	*Dodecahema leptoceras*	FE	CE	1B.1			X					X
small-leaved rose	*Rosa minutifolia*	--	CE	2.1		X						
smooth tarplant	*Centromadia pungens ssp. laevis*	--	--	1B.1	X	X						
snake cholla	*Opuntia californica var. californica*	--	--	1B.1	X	X						
Sonoran maiden fern	*Thelypteris puberula var. sonorensis*	--	--	2.2					X		X	
South Coast saltscale	*Atriplex pacifica*	--	--	1B.2	X	X	X					
southern jewel-flower	*Streptanthus campestris*	--	--	1B.3							X	
southern mountains skullcap	*Scutellaria bolanderi ssp. austromontana*	--	--	1B.2			X					
southern tarplant	*Centromadia parryi ssp. australis*	--	--	1B.1	X	X	X		X		X	X
spreading navarretia	*Navarretia fossalis*	FT	--	1B.1	X	X	X					
sticky dudleya	*Dudleya viscida*	--	--	1B.2	X	X						
straight-awned spineflower	*Chorizanthe rectispina*	--	--	1B.3						X		
summer holly	*Comarostaphylis diversifolia ssp. diversifolia*	--	--	1B.2	X	X						
surf thistle	*Cirsium rhothophilum*	--	CT	1B.2						X	X	
Tecate cypress	*Hesperocyparis forbesii*	--	--	1B.1	X	X						
thread-leaved brodiaea	*Brodiaea filifolia*	FT	CE	1B.1	X	X						
torrey pine	*Pinus torreyana ssp. torreyana*	--	--	1B.2		X						
umbrella larkspur	*Delphinium umbraculorum*	--	--	1B.3						X	X	
Vandenberg monkeyflower	*Mimulus fremontii var. vandenbergensis*	FC	--	1B.1						X		
variegated dudleya	*Dudleya variegata*	--	--	1B.2	X	X						
Ventura Marsh milk-vetch	*Astragalus pycnostachyus var. lanosissimus*	FE	CE	1B.1			X	X			X	
Verity's dudleya	*Dudleya verityi*	FT	--	1B.2				X				X
wart-stemmed ceanothus	*Ceanothus verrucosus*	--	--	2.2	X	X						
white rabbit-tobacco	*Pseudognaphalium leucocephalum*	--	--	2.2	X	X	X		X			
willowy monardella	*Monardella viminea*	FE	CE	1B.1	X	X						
Wildlife												
American badger	*Taxidea taxus*	--	--	CSC	X	X	X	X	X	X	X	X
American peregrine falcon	*Falco peregrinus anatum*	FD	CD	FP		X	X					
arroyo chub	*Gila orcuttii*	--	--	CSC	X	X	X	X	X		X	X
arroyo toad	*Anaxyrus californicus*	FE	--	CSC	X	X	X			X		
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP						X		
bank swallow	*Riparia riparia*	--	CT	--		X		X	X		X	
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	--	CE	--	X	X	X	X	X		X	
big free-tailed bat	*Nyctinomops macrotis*	--	--	CSC	X	X	X				X	
black skimmer	*Rynchops niger*	--	--	CSC			X					
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X	X	X			X
California black rail	*Laterallus jamaicensis coturniculus*	--	CT	FP		X	X					
California brown pelican	*Pelecanus occidentalis californicus*	FD	CD	FP		X	X**	X	X			
California condor	*Gymnogyps californianus*	FE	CE	--							X	
California leaf-nosed bat	*Macrotus californicus*	--	--	CSC	X		X					X
California least tern	*Sternula antillarum browni*	FE	CE	FP	X	X	X	X		X	X	
California mountain kingsnake (San Diego population)	*Lampropeltis zonata (pulchra)*	--	--	CSC					X			
California red-legged frog	*Rana draytonii*	FT	--	CSC						X	X	X
California spotted owl	*Strix occidentalis occidentalis*	--	--	CSC							X	
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC						X		
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X	X	X	X	X	X	X	X
coast patch-nosed snake	*Salvadora hexalepis virgultea*	--	--	CSC	X		X			X		
Coast Range newt	*Taricha torosa*	--	--	CSC	X		X				X	
coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	--	--	CSC	X	X	X					
coastal California gnatcatcher	*Polioptila californica californica*	FT	--	CSC	X	X	X	X			X	X
Coronado Island skink	*Plestiodon skiltonianus interparietalis*	--	--	CSC	X	X						
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	--	--	CSC	X	X					X	
El Segundo blue butterfly	*Euphilotes battoides allyni*	FE	--	--			X					
foothill yellow-legged frog	*Rana boylii*	--	--	CSC				X		X	X	
golden eagle	*Aquila chrysaetos*	--	--	FP	X	X	X		X			X
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC	X		X					
green turtle	*Chelonia mydas*	FT	--	--		X	X					
least Bell's vireo	*Vireo bellii pusillus*	FE	CE	--	X	X	X	X	X	X	X	X
least bittern	*Ixobrychus exilis*	--	--	CSC	X							
light-footed clapper rail	*Rallus longirostris levipes*	FE	CE	FP	X	X	X	X			X	
long-eared owl	*Asio otus*	--	--	CSC	X							
Los Angeles pocket mouse	*Perognathus longimembris brevinasus*	--	--	CSC			X					
marbled murrelet*	*Brachyramphus marmoratus*	FT	CE	--						X		

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Southern California Coast Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection							
		FESA	CESA	Other DFG	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains
Mexican long-tongued bat	*Choeronycteris mexicana*	--	--	CSC	X	X	X	X			X	
Mohave tui chub	*Siphateles bicolor mohavensis*	FE	CE	FP			X					
northern harrier	*Circus cyaneus*	--	--	CSC	X	X						
northern leopard frog	*Lithobates pipiens*	--	--	CSC	X							
northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	--	--	CSC	X	X						
orangethroat whiptail	*Aspidoscelis hyperythra*	--	--	CSC	X	X	X					
Pacific pocket mouse	*Perognathus longimembris pacificus*	FE	--	CSC	X	X	X					
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	X	X	X	X	X	X
Palos Verdes blue butterfly	*Glaucopsyche lygdamus palosverdesensis*	FE	--	--			X					
pocketed free-tailed bat	*Nyctinomops femorosaccus*	--	--	CSC	X	X	X					
quino checkerspot butterfly	*Euphydryas editha quino*	FE	--	--	X	X						
red-diamond rattlesnake	*Crotalus ruber*	--	--	CSC	X	X	X					
Riverside fairy shrimp	*Streptocephalus woottoni*	FE	--	--	X	X						X
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	--	--	CSC	X	X	X					
San Diego desert woodrat	*Neotoma lepida intermedia*	--	--	CSC	X	X	X	X	X	X	X	X
San Diego fairy shrimp	*Branchinecta sandiegonensis*	FE	--	--	X	X	X					
Santa Ana speckled dace	*Rhinichthys osculus ssp. 3*	--	--	CSC	X		X					
Santa Ana sucker	*Catostomus santaanae*	FT	--	CSC	X		X	X			X	X
Sierra Madre yellow-legged frog	*Rana muscosa*	FE	CCE	CSC			X					
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC	X	X	X	X	X	X		X
south coast garter snake	*Thamnophis sirtalis ssp.*	--	--	CSC	X	X		X				
south coast marsh vole	*Microtus californicus stephensi*	--	--	CSC			X	X	X			
southern California saltmarsh shrew	*Sorex ornatus salicornicus*	--	--	CSC			X	X	X			
southern grasshopper mouse	*Onychomys torridus ramona*	--	--	CSC			X					
southern steelhead - southern California DPS	*Oncorhynchus mykiss irideus*	FE	--	CSC	X	X		X	X	X	X	
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	CE	--	X	X	X	X	X	X	X	
spotted bat	*Euderma maculatum*	--	--	CSC		X			X			
Stephens' kangaroo rat	*Dipodomys stephensi*	FE	CT	--	X							
tidewater goby	*Eucyclogobius newberryi*	FE	--	CSC	X	X		X	X	X	X	
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X					X	X	
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X	X			X	X	
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC	X	X	X	X	X	X	X	X
unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	FE	CE	FP				X		X	X	X
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X	X	X		X	X	X	X
western pond turtle	*Emys marmorata*	--	--	CSC	X	X	X	X	X	X	X	X
western red bat	*Lasiurus blossevillii*	--	--	CSC	X	X			X	X	X	
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC	X	X	X	X		X	X	
western spadefoot	*Spea hammondii*	--	--	CSC	X	X	X	X		X		X
western yellow bat	*Lasiurus xanthinus*	--	--	CSC	X	X	X					
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--		X	X	X				X
white-tailed kite	*Elanus leucurus*	--	--	FP	X	X	X	X			X	
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC	X	X		X		X		X
yellow-breasted chat	*Icteria virens*	--	--	CSC	X	X	X	X				X
Natural Communities												
California Walnut Woodland	*California Walnut Woodland*	--	--	--	X		X	X	X		X	X
Central Coast Arroyo Willow Riparian Forest	*Central Coast Arroyo Willow Riparian Forest*	--	--	--						X	X	
Central Dune Scrub	*Central Dune Scrub*	--	--	--						X	X	
Central Foredunes	*Central Foredunes*	--	--	--						X		
Central Maritime Chaparral	*Central Maritime Chaparral*	--	--	--						X	X	
Cismontane Alkali Marsh	*Cismontane Alkali Marsh*	--	--	--								X
Coastal and Valley Freshwater Marsh	*Coastal and Valley Freshwater Marsh*	--	--	--				X		X		
Coastal Brackish Marsh	*Coastal Brackish Marsh*	--	--	--		X						
Maritime Succulent Scrub	*Maritime Succulent Scrub*	--	--	--	X	X						
Northern Coastal Salt Marsh	*Northern Coastal Salt Marsh*	--	--	--						X	X	
Open Engelmann Oak Woodland	*Open Engelmann Oak Woodland*	--	--	--			X					
Riversidian Alluvial Fan Sage Scrub	*Riversidian Alluvial Fan Sage Scrub*	--	--	--	X		X					
San Diego Mesa Claypan Vernal Pool	*San Diego Mesa Claypan Vernal Pool*	--	--	--	X	X						
San Diego Mesa Hardpan Vernal Pool	*San Diego Mesa Hardpan Vernal Pool*	--	--	--	X	X						
Southern California Arroyo Chub/Santa Ana Sucker Stream	*Southern California Arroyo Chub/Santa Ana Sucker Stream*	--	--	--			X					
Southern California Coastal Lagoon	*Southern California Coastal Lagoon*	--	--	--				X	X	X	X	
Southern California Steelhead Stream	*Southern California Steelhead Stream*	--	--	--				X	X	X	X	
Southern California Threespine Stickleback Stream	*Southern California Threespine Stickleback Stream*	--	--	--				X		X		X
Southern Coast Live Oak Riparian Forest	*Southern Coast Live Oak Riparian Forest*	--	--	--	X	X	X	X	X	X	X	X
Southern Coastal Bluff Scrub	*Southern Coastal Bluff Scrub*	--	--	--			X					
Southern Coastal Salt Marsh	*Southern Coastal Salt Marsh*	--	--	--		X	X	X	X		X	
Southern Cottonwood Willow Riparian Forest	*Southern Cottonwood Willow Riparian Forest*	--	--	--	X	X	X			X	X	X
Southern Dune Scrub	*Southern Dune Scrub*	--	--	--		X	X					
Southern Foredunes	*Southern Foredunes*	--	--	--		X	X					
Southern Interior Cypress Forest	*Southern Interior Cypress Forest*	--	--	--	X							
Southern Maritime Chaparral	*Southern Maritime Chaparral*	--	--	--	X	X						
Southern Mixed Riparian Forest	*Southern Mixed Riparian Forest*	--	--	--	X		X					X
Southern Riparian Forest	*Southern Riparian Forest*	--	--	--	X	X						X
Southern Riparian Scrub	*Southern Riparian Scrub*	--	--	--	X	X		X				X
Southern Sycamore Alder Riparian Woodland	*Southern Sycamore Alder Riparian Woodland*	--	--	--	X	X	X	X	X		X	X
Southern Vernal Pool	*Southern Vernal Pool*	--	--	--						X		
Southern Willow Scrub	*Southern Willow Scrub*	--	--	--	X	X	X	X		X	X	X
Torrey Pine Forest	*Torrey Pine Forest*	--	--	--		X						
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--	X	X	X		X	X	X	X
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--					X			X
Walnut Forest	*Walnut Forest*	--	--	--			X					

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):

- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):

- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):

- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-15. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern California Mountains and Valleys Section

Common Name	Scientific Name	Status[1] FESA	CESA	Other DFG	USFS Ecological Subsection: Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Park	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills
Plants																
Abrams' oxytheca	*Acanthoscyphus parishii var. abramsii*	--	--	1B.2				X								
Abrams' spurge	*Chamaesyce abramsiana*	--	--	2.2	X											
alkali mariposa-lily	*Calochortus striatus*	--	--	1B.2			X									
Alvin Meadow bedstraw	*Galium californicum ssp. primum*	--	--	1B.2		X				X			X			
annual rock-nettle	*Eucnide rupestris*	--	--	2.2	X											
appressed muhly	*Muhlenbergia appressa*	--	--	2.2					X							
Arizona carlowrightia	*Carlowrightia arizonica*	--	--	2.2	X											
Arizona cottontop	*Digitaria californica*	--	--	2.3	X											
Arizona pholistoma	*Pholistoma auritum var. arizonicum*	--	--	2.3	X											
Arizona pussypaws	*Calyptridium arizonicum*	--	--	2.1	X											
Arizona spurge	*Chamaesyce arizonica*	--	--	2.3	X											
ash-gray paintbrush	*Castilleja cinerea*	FT	--	1B.2							X				X	
Baja navarretia	*Navarretia peninsularis*	--	--	1B.2				X	X		X				X	
Baldwin Lake linanthus	*Linanthus killipii*	--	--	1B.2							X				X	
Barton Flats horkelia	*Horkelia wilderae*	--	--	1B.1											X	
Bear Lake buckwheat	*Eriogonum microthecum var. lacus-ursi*	--	--	1B.1											X	
Bear Valley pyrrocoma	*Pyrrocoma uniflora var. gossypina*	--	--	1B.2							X				X	
Beaver Dam breadroot	*Pediomelum castoreum*	--	--	1B.2			X				X					
Big Bear Valley milk-vetch	*Astragalus lentiginosus var. sierrae*	--	--	1B.2			X				X				X	
Big Bear Valley phlox	*Phlox dolichantha*	--	--	1B.2			X				X				X	
Big Bear Valley sandwort	*Eremogone ursina*	FT	--	1B.2							X				X	
Big Bear Valley woollypod	*Astragalus leucolobus*	--	--	1B.2			X				X		X		X	
bird-foot checkerbloom	*Sidalcea pedata*	FE	CE	1B.1							X				X	
black bog-rush	*Schoenus nigricans*	--	--	2.2							X					
Booth's evening-primrose	*Camissonia boothii ssp. boothii*	--	--	2.3			X									
Borrego bedstraw	*Galium angustifolium ssp. borregoense*	--	CR	1B.3	X											
Borrego Valley pepper-grass	*Lepidium flavum var. felipense*	--	--	1B.2	X				X							
bottle liverwort	*Sphaerocarpos drewei*	--	--	1B.1										X		
bristly scaleseed	*Spermolepis echinata*	--	--	2.3	X											
bristly sedge	*Carex comosa*	--	--	2.1		X										
broad-nerved hump moss	*Meesia uliginosa*	--	--	2.2									X			
brown turbans	*Malperia tenuis*	--	--	2.3	X											
California adolphia	*Adolphia californica*	--	--	2.1												X
California ayenia	*Ayenia compacta*	--	--	2.3	X				X				X	X		
California beardtongue	*Penstemon californicus*	--	--	1B.2	X					X		X	X			
California dandelion	*Taraxacum californicum*	FE	--	1B.1							X				X	
California marina	*Marina orcuttii var. orcuttii*	--	--	1B.3	X											
California Orcutt grass	*Orcuttia californica*	FE	CE	1B.1					X	X				X		
California satintail	*Imperata brevifolia*	--	--	2.1	X	X					X				X	
California saw-grass	*Cladium californicum*	--	--	2.2		X									X	
California screw moss	*Tortula californica*	--	--	1B.2										X		
Campbell's liverwort	*Geothallus tuberosus*	--	--	1B.1										X		
Cedros Island oak	*Quercus cedrosensis*	--	--	2.2												X
chaparral ash	*Fraxinus parryi*	--	--	2.2												X
chaparral nolina	*Nolina cismontana*	--	--	1B.2										X		X
chaparral ragwort	*Senecio aphanactis*	--	--	2.2	X	X										
chaparral sand-verbena	*Abronia villosa var. aurita*	--	--	1B.1	X	X			X	X		X	X	X		
Cienega Seca oxytheca	*Acanthoscyphus parishii var. cienegensis*	--	--	1B.3							X				X	
cliff cinquefoil	*Potentilla rimicola*	--	--	2.3									X			
cliff spurge	*Euphorbia misera*	--	--	2.2	X											
Coachella Valley milk-vetch	*Astragalus lentiginosus var. coachellae*	FE	--	1B.2	X	X	X									
Coulter's goldfields	*Lasthenia glabrata ssp. coulteri*	--	--	1B.1		X				X		X	X	X		
Coulter's saltbush	*Atriplex coulteri*	--	--	1B.2		X										X
Cove's cassia	*Senna covesii*	--	--	2.2	X				X				X			X
curly herissantia	*Herissantia crispa*	--	--	2.3	X											
Cushenbury buckwheat	*Eriogonum ovalifolium var. vineum*	FE	--	1B.1			X				X				X	
Cushenbury milk-vetch	*Astragalus albens*	FE	--	1B.1			X				X					
Cushenbury oxytheca	*Acanthoscyphus parishii var. goodmaniana*	FE	--	1B.1			X				X				X	
Cuyamaca cypress	*Hesperocyparis stephensonii*	--	--	1B.1					X							X
Cuyamaca Lake downingia	*Downingia concolor var. brevior*	--	CE	1B.1					X							
Cuyamaca larkspur	*Delphinium hesperium ssp. cuyamacae*	--	CR	1B.2					X			X	X			
Cuyamaca raspberry	*Rubus glaucifolius var. ganderi*	--	--	1B.3					X							
Darwin rock-cress	*Arabis pulchra var. munciensis*	--	--	2.3			X									
Davidson's saltscale	*Atriplex serenana var. davidsonii*	--	--	1B.2		X				X						
Dean's milk-vetch	*Astragalus deanei*	--	--	1B.1					X							X
decumbent goldenbush	*Isocoma menziesii var. decumbens*	--	--	1B.2												X
Deep Canyon snapdragon	*Antirrhinum cyathiferum*	--	--	2.3	X											
Dehesa nolina	*Nolina interrata*	--	CE	1B.1												X
Del Mar manzanita	*Arctostaphylos glandulosa ssp. crassifolia*	FE	--	1B.1												X
delicate clarkia	*Clarkia delicata*	--	--	1B.2					X							X
desert beauty	*Linanthus bellus*	--	--	2.3	X				X			X				
desert spike-moss	*Selaginella eremophila*	--	--	2.2	X		X		X							
Dunn's mariposa-lily	*Calochortus dunnii*	--	CR	1B.2					X							X
dwarf germander	*Teucrium cubense ssp. depressum*	--	--	2.2	X											
El Paso gilia	*Gilia mexicana*	--	--	2.3	X											
Emory's crucifixion-thorn	*Castela emoryi*	--	--	2.3	X											
Encinitas baccharis	*Baccharis vanessae*	FT	CE	1B.1										X		X
Ewan's cinquefoil	*Drymocallis cuneifolia var. ewanii*	--	--	1B.3											X	
felt-leaved monardella	*Monardella hypoleuca ssp. lanata*	--	--	1B.2					X					X		X
flat-seeded spurge	*Chamaesyce platysperma*	--	--	1B.2	X											
Fremont's gentian	*Gentiana fremontii*	--	--	2.3											X	
Gambel's water cress	*Nasturtium gambelii*	FE	CT	1B.1		X										
Gander's cryptantha	*Cryptantha ganderi*	--	--	1B.1	X											
Gander's pitcher sage	*Lepechinia ganderi*	--	--	1B.3												X
Gander's ragwort	*Packera ganderi*	--	CR	1B.2												X
glandular ditaxis	*Ditaxis claryana*	--	--	2.2	X											
Greata's aster	*Symphyotrichum greatae*	--	--	1B.3				X								
hairy stickleaf	*Mentzelia hirsutissima*	--	--	2.3	X											
Hall's monardella	*Monardella macrantha ssp. hallii*	--	--	1B.3					X		X	X	X	X	X	
Hammitt's clay-cress	*Sibaropsis hammittii*	--	--	1B.2										X		X
Harwood's milk-vetch	*Astragalus insularis var. harwoodii*	--	--	2.2	X											
heart-leaved pitcher sage	*Lepechinia cardiophylla*	--	--	1B.2										X		X
Hidden Lake bluecurls	*Trichostema austromontanum ssp. compactum*	FT	--	1B.1									X			
Hirshberg's rock-cress	*Arabis hirshbergiae*	--	--	1B.2					X							
Horn's milk-vetch	*Astragalus hornii var. hornii*	--	--	1B.1		X										
hot springs fimbristylis	*Fimbristylis thermalis*	--	--	2.2							X					
intermediate mariposa-lily	*Calochortus weedii var. intermedius*	--	--	1B.2						X				X		
Jacumba milk-vetch	*Astragalus douglasii var. perstrictus*	--	--	1B.2	X				X							X
Jaeger's milk-vetch	*Astragalus pachypus var. jaegeri*	--	--	1B.1	X	X			X	X		X		X		X
Jennifer's monardella	*Monardella stoneana*	--	--	1B.2												X
Johnston's buckwheat	*Eriogonum microthecum var. johnstonii*	--	--	1B.3			X				X				X	
Johnston's rock-cress	*Arabis johnstonii*	--	--	1B.2								X	X			
Laguna Mountains alumroot	*Heuchera brevistaminea*	--	--	1B.3					X							
Laguna Mountains goldenbush	*Ericameria cuneata var. macrocephala*	--	--	1B.3					X							
Lakeside ceanothus	*Ceanothus cyaneus*	--	--	1B.2					X	X						X
Latimer's woodland-gilia	*Saltugilia latimeri*	--	--	1B.2	X		X				X					
Lemmon's jewel-flower	*Caulanthus lemmonii*	--	--	1B.2				X								
lemon lily	*Lilium parryi*	--	--	1B.2	X	X	X		X	X	X	X	X	X	X	X
little purple monkeyflower	*Mimulus purpureus*	--	--	1B.2							X				X	
Little San Bernardino Mtns. linanthus	*Linanthus maculatus*	--	--	1B.2			X				X					
little-leaf elephant tree	*Bursera microphylla*	--	--	2.3	X											
long-spined spineflower	*Chorizanthe polygonoides var. longispina*	--	--	1B.2					X	X		X	X	X		X

Table I-15. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern California Mountains and Valleys Section

		Status[1]			USFS Ecological Subsection											
Common Name	Scientific Name	FESA	CESA	Other DFG	Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Park	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills
male fern	*Dryopteris filix-mas*	--	--	2.3							X				X	
many-stemmed dudleya	*Dudleya multicaulis*	--	--	1B.2		X				X				X		
marsh sandwort	*Arenaria paludicola*	FE	CE	1B.1		X				X						
Mecca-aster	*Xylorhiza cognata*	--	--	1B.2	X											
mesa horkelia	*Horkelia cuneata ssp. puberula*	--	--	1B.1		X				X				X		X
Mexican flannelbush	*Fremontodendron mexicanum*	FE	CR	1B.1												X
Mexican hulsea	*Hulsea mexicana*	--	--	2.3	X				X							
Mojave milkweed	*Asclepias nyctaginifolia*	--	--	2.1							X					
Mojave tarplant	*Deinandra mohavensis*	--	CE	1B.3			X		X	X	X	X	X			
Moreno currant	*Ribes canthariforme*	--	--	1B.3					X							X
Mount Laguna aster	*Dieteria asteroides var. lagunensis*	--	CR	2.1	X				X							
Mountain Springs bush lupine	*Lupinus excubitus var. medius*	--	--	1B.3	X				X							
Mt. Pinos onion	*Allium howellii var. clokeyi*	--	--	1B.3				X								
mud nama	*Nama stenocarpum*	--	--	2.2					X	X						
Munz's onion	*Allium munzii*	FE	CT	1B.1						X				X		
Munz's sage	*Salvia munzii*	--	--	2.2												X
Nevin's barberry	*Berberis nevinii*	FE	CE	1B.1	X	X			X	X	X	X			X	
Nuttall's scrub oak	*Quercus dumosa*	--	--	1B.1												X
Orcutt's brodiaea	*Brodiaea orcuttii*	--	--	1B.1					X			X		X		X
Orcutt's linanthus	*Linanthus orcuttii*	--	--	1B.3			X		X			X			X	
Orcutt's pincushion	*Chaenactis glabriuscula var. orcuttiana*	--	--	1B.1					X							
Orcutt's woody-aster	*Xylorhiza orcuttii*	--	--	1B.2	X				X							
Otay manzanita	*Arctostaphylos otayensis*	--	--	1B.2	X				X			X				X
Otay Mountain ceanothus	*Ceanothus otayensis*	--	--	1B.2												X
Otay Mountain lotus	*Hosackia crassifolia var. otayensis*	--	--	1B.1												X
pale-yellow layia	*Layia heterotricha*	--	--	1B.1				X								
Palmer's goldenbush	*Ericameria palmeri var. palmeri*	--	--	1B.1												X
Palmer's jackass clover	*Wislizenia refracta ssp. palmeri*	--	--	2.2	X											
Palmer's mariposa-lily	*Calochortus palmeri var. palmeri*	--	--	1B.2			X	X			X	X	X		X	
Parish's alumroot	*Heuchera parishii*	--	--	1B.3							X		X		X	
Parish's brittlescale	*Atriplex parishii*	--	--	1B.1	X					X		X	X			X
Parish's chaenactis	*Chaenactis parishii*	--	--	1B.3					X	X		X	X			
Parish's checkerbloom	*Sidalcea hickmanii ssp. parishii*	--	CR	1B.2							X				X	
Parish's daisy	*Erigeron parishii*	FT	--	1B.1			X				X				X	
Parish's desert-thorn	*Lycium parishii*	--	--	2.3	X	X					X				X	
Parish's meadowfoam	*Limnanthes gracilis ssp. parishii*	--	CE	1B.2	X				X				X	X		
Parish's rock-cress	*Boechera parishii*	--	--	1B.2			X				X				X	
Parish's yampah	*Perideridia parishii ssp. parishii*	--	--	2.2							X				X	
Parry's spineflower	*Chorizanthe parryi var. parryi*	--	--	1B.1	X	X	X			X	X	X	X	X		
Parry's tetracoccus	*Tetracoccus dioicus*	--	--	1B.2	X				X			X		X		X
Peirson's pincushion	*Chaenactis carphoclinia var. peirsonii*	--	--	1B.3	X											
Peruvian dodder	*Cuscuta obtusiflora var. glandulosa*	--	--	2.2		X										
pink fairy-duster	*Calliandra eriophylla*	--	--	2.3	X											
pinyon rock-cress	*Boechera dispar*	--	--	2.3			X				X				X	
Plummer's mariposa-lily	*Calochortus plummerae*	--	--	1B.2		X				X	X	X	X	X	X	
prairie wedge grass	*Sphenopholis obtusata*	--	--	2.2		X			X						X	X
prostrate vernal pool navarretia	*Navarretia prostrata*	--	--	1B.1		X								X		
purple stemodia	*Stemodia durantifolia*	--	--	2.1	X											X
pygmy hulsea	*Hulsea vestita ssp. pygmaea*	--	--	1B.3											X	
pygmy lotus	*Acmispon haydonii*	--	--	1B.3	X											
pygmy pussypaws	*Calyptridium pygmaeum*	--	--	1B.2							X				X	
Rainbow manzanita	*Arctostaphylos rainbowensis*	--	--	1B.1						X				X		X
Ramona horkelia	*Horkelia truncata*	--	--	1B.3					X					X		X
rigid fringepod	*Thysanocarpus rigidus*	--	--	1B.2	X	X			X							
Robbins' nemacladus	*Nemacladus secundiflorus var. robbinsii*	--	--	1B.2				X								
Robinson's pepper-grass	*Lepidium virginicum var. robinsonii*	--	--	1B.2		X			X	X	X	X		X		X
Robison's monardella	*Monardella robisonii*	--	--	1B.3			X									
rock sandwort	*Arenaria lanuginosa var. saxosa*	--	--	2.3											X	
rock-loving oxytrope	*Oxytropis oreophila var. oreophila*	--	--	2.3											X	
Ross' pitcher sage	*Lepechinia rossii*	--	--	1B.2				X								
round-leaved filaree	*California macrophylla*	--	--	1B.1		X		X		X						X
salt marsh bird's-beak	*Chloropyron maritimum ssp. maritimum*	FE	CE	1B.2		X			X	X		X				
Salt Spring checkerbloom	*Sidalcea neomexicana*	--	--	2.2		X		X	X	X						
San Bernardino aster	*Symphyotrichum defoliatum*	--	--	1B.2	X	X			X	X	X	X	X	X	X	X
San Bernardino blue grass	*Poa atropurpurea*	FE	--	1B.2					X		X				X	
San Bernardino gilia	*Gilia leptantha ssp. leptantha*	--	--	1B.3		X					X				X	
San Bernardino grass-of-Parnassus	*Parnassia cirrata var. cirrata*	--	--	1B.3							X				X	
San Bernardino milk-vetch	*Astragalus bernardinus*	--	--	1B.2			X				X				X	
San Bernardino Mountains bladderpod	*Physaria kingii ssp. bernardina*	FE	--	1B.1							X				X	
San Bernardino Mountains dudleya	*Dudleya abramsii ssp. affinis*	--	--	1B.2			X				X				X	
San Bernardino Mountains monkeyflower	*Mimulus exiguus*	--	--	1B.2							X				X	
San Bernardino Mountains owl's-clover	*Castilleja lasiorhyncha*	--	--	1B.2			X				X		X		X	
San Bernardino ragwort	*Packera bernardina*	--	--	1B.2							X				X	
San Bernardino rock-cress	*Boechera peirsonii*	--	--	1B.2											X	
San Diego ambrosia	*Ambrosia pumila*	FE	--	1B.1		X				X				X		X
San Diego button-celery	*Eryngium aristulatum var. parishii*	FE	CE	1B.1	X									X		X
San Diego County alumroot	*Heuchera rubescens var. versicolor*	--	--	2.3					X							
San Diego goldenstar	*Bloomeria clevelandii*	--	--	1B.1					X							X
San Diego gumplant	*Grindelia hallii*	--	--	1B.2					X							X
San Diego hulsea	*Hulsea californica*	--	--	1B.3					X			X				
San Diego marsh-elder	*Iva hayesiana*	--	--	2.2												X
San Diego milk-vetch	*Astragalus oocarpus*	--	--	1B.2	X				X			X				X
San Diego thorn-mint	*Acanthomintha ilicifolia*	FT	CE	1B.1												X
San Felipe monardella	*Monardella nana ssp. leptosiphon*	--	--	1B.2	X				X				X			
San Fernando Valley spineflower	*Chorizanthe parryi var. fernandina*	FC	CE	1B.1				X								
San Gabriel bedstraw	*Galium grande*	--	--	1B.2				X								
San Jacinto linanthus	*Linanthus jaegeri*	--	--	1B.2									X			
San Jacinto mariposa-lily	*Calochortus palmeri var. munzii*	--	--	1B.2								X	X			
San Jacinto Mountains bedstraw	*Galium angustifolium ssp. jacinticum*	--	--	1B.3	X				X			X	X			
San Jacinto Valley crownscale	*Atriplex coronata var. notatior*	FE	--	1B.1						X						
San Miguel savory	*Satureja chandleri*	--	--	1B.2						X		X		X		X
Sanford's arrowhead	*Sagittaria sanfordii*	--	--	1B.2		X										
Santa Ana River woollystar	*Eriastrum densifolium ssp. sanctorum*	FE	CE	1B.1		X					X					
Santa Lucia dwarf rush	*Juncus luciensis*	--	--	1B.2					X					X		
Santa Rosa Mountains leptosiphon	*Leptosiphon floribundus ssp. hallii*	--	--	1B.3	X							X	X			
Santiago Peak phacelia	*Phacelia keckii*	--	--	1B.3								X		X		
scalloped moonwort	*Botrychium crenulatum*	--	--	2.2							X				X	
shaggy-haired alumroot	*Heuchera hirsutissima*	--	--	1B.3	X								X			
Shevock's copper moss	*Schizymenium shevockii*	--	--	1B.2										X		
Shockley's rock-cress	*Boechera shockleyi*	--	--	2.2			X				X				X	
short-joint beavertail	*Opuntia basilaris var. brachyclada*	--	--	1B.2				X			X					
short-sepaled lewisia	*Lewisia brachycalyx*	--	--	2.2					X		X				X	
silver-haired ivesia	*Ivesia argyrocoma var. argyrocoma*	--	--	1B.2							X				X	
single-leaved skunkbrush	*Rhus trilobata var. simplicifolia*	--	--	2.3	X											
singlewhorl burrobrush	*Ambrosia monogyra*	--	--	2.2	X	X										
slender cottonheads	*Nemacaulis denudata var. gracilis*	--	--	2.2	X											
slender mariposa-lily	*Calochortus clavatus var. gracilis*	--	--	1B.2				X								
slender-horned spineflower	*Dodecahema leptoceras*	FE	CE	1B.1		X				X	X	X		X		
slender-leaved ipomopsis	*Ipomopsis tenuifolia*	--	--	2.3	X											
slender-petaled thelypodium	*Thelypodium stenopetalum*	FE	CE	1B.1							X				X	
slender-stem bean	*Phaseolus filiformis*	--	--	2.1	X											
smooth tarplant	*Centromadia pungens ssp. laevis*	--	--	1B.1		X				X		X		X		X
Sonoran maiden fern	*Thelypteris puberula var. sonorensis*	--	--	2.2	X						X					
South Coast saltscale	*Atriplex pacifica*	--	--	1B.2						X						

Table I-15. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern California Mountains and Valleys Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection											
		FESA	CESA	Other DFG	Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Park	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills
southern alpine buckwheat	*Eriogonum kennedyi var. alpigenum*	--	--	1B.3				X							X	
Southern California rock draba	*Draba saxosa*	--	--	1B.3									X			
southern jewel-flower	*Streptanthus campestris*	--	--	1B.3	X				X		X	X	X		X	
southern mountain buckwheat	*Eriogonum kennedyi var. austromontanum*	FT	--	1B.2			X				X				X	
southern mountains skullcap	*Scutellaria bolanderi ssp. austromontana*	--	--	1B.2					X			X	X	X		X
southern tarplant	*Centromadia parryi ssp. australis*	--	--	1B.1												X
spear-leaf matelea	*Matelea parvifolia*	--	--	2.3	X											
spiny-hair blazing star	*Mentzelia tricuspis*	--	--	2.1		X						X				
spreading navarretia	*Navarretia fossalis*	FT	--	1B.1						X				X		X
sticky dudleya	*Dudleya viscida*	--	--	1B.2										X		
sticky geraea	*Geraea viscida*	--	--	2.3	X				X							X
summer holly	*Comarostaphylis diversifolia ssp. diversifolia*	--	--	1B.2										X		X
Tahquitz ivesia	*Ivesia callida*	--	CR	1B.3									X			
Tecate cypress	*Hesperocyparis forbesii*	--	--	1B.1					X					X		X
Tecate tarplant	*Deinandra floribunda*	--	--	1B.2	X				X							X
Tehachapi monardella	*Monardella linoides ssp. oblonga*	--	--	1B.3				X								
thread-leaved brodiaea	*Brodiaea filifolia*	FT	CE	1B.1						X	X			X		
Tidestrom's milk-vetch	*Astragalus tidestromii*	--	--	2.2			X									
timberland blue-eyed grass	*Sisyrinchium longipes*	--	--	2.2											X	
triple-ribbed milk-vetch	*Astragalus tricarinatus*	FE	--	1B.2	X		X				X					
Vail Lake ceanothus	*Ceanothus ophiochilus*	FT	CE	1B.1						X		X				
vanishing wild buckwheat	*Eriogonum evanidum*	--	--	1B.1					X		X	X			X	X
variegated dudleya	*Dudleya variegata*	--	--	1B.2												X
velvety false lupine	*Thermopsis californica var. semota*	--	--	1B.2					X							X
Warner Springs lessingia	*Lessingia glandulifera var. tomentosa*	--	--	1B.3	X				X			X				
wart-stemmed ceanothus	*Ceanothus verrucosus*	--	--	2.2					X							X
western sedge	*Carex occidentalis*	--	--	2.3							X		X		X	
white bog adder's-mouth	*Malaxis monophyllos var. brachypoda*	--	--	2.1									X		X	
white rabbit-tobacco	*Pseudognaphalium leucocephalum*	--	--	2.2						X		X		X		
white-bracted spineflower	*Chorizanthe xanti var. leucotheca*	--	--	1B.2	X	X	X				X	X	X			
white-margined everlasting	*Antennaria marginata*	--	--	2.3											X	
white-margined oxytheca	*Sidotheca emarginata*	--	--	1B.3	X							X	X			
woolly mountain-parsley	*Oreonana vestita*	--	--	1B.3											X	
Wright's trichocoronis	*Trichocoronis wrightii var. wrightii*	--	--	2.1						X						
Yucaipa onion	*Allium marvinii*	--	--	1B.1		X					X	X	X			
Ziegler's aster	*Dieteria canescens var. ziegleri*	--	--	1B.2									X			
Wildlife																
American badger	*Taxidea taxus*	--	--	CSC	X	X	X	X		X	X	X			X	X
arroyo chub	*Gila orcuttii*	--	--	CSC		X			X	X		X		X	X	X
arroyo toad	*Anaxyrus californicus*	FE	--	CSC			X	X	X	X	X	X	X	X		X
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP						X	X	X	X	X	X	
barefoot gecko	*Coleonyx switaki*	--	CT	--	X				X							
Bendire's thrasher	*Toxostoma bendirei*	--	--	CSC			X					X				
big free-tailed bat	*Nyctinomops macrotis*	--	--	CSC	X	X			X					X		X
black swift	*Cypseloides niger*	--	--	CSC	X							X	X		X	
blunt-nosed leopard lizard	*Gambelia sila*	FE	CE	FP				X								
burrowing owl	*Athene cunicularia*	--	--	CSC	X	X	X	X		X		X		X		X
California condor	*Gymnogyps californianus*	FE	CE	--				X								
California leaf-nosed bat	*Macrotus californicus*	--	--	CSC	X											X
California mountain kingsnake (San Bernardino population)	*Lampropeltis zonata (parvirubra)*	--	--	CSC			X				X	X	X			
California mountain kingsnake (San Diego population)	*Lampropeltis zonata (pulchra)*	--	--	CSC					X					X		
California red-legged frog	*Rana draytonii*	FT	--	CSC	X			X			X			X		
California spotted owl	*Strix occidentalis occidentalis*	--	--	CSC			X	X	X		X		X	X	X	X
California tiger salamander	*Ambystoma californiense*	FT	CT	CSC						X		X	X			
Casey's June beetle	*Dinacoma caseyi*	FPE	--	--	X											
Coachella Valley fringe-toed lizard	*Uma inornata*	FT	CE	--	X		X				X					
coast horned lizard	*Phrynosoma blainvillii*	--	--	CSC	X	X	X	X	X	X	X	X	X	X	X	X
coast patch-nosed snake	*Salvadora hexalepis virgultea*	--	--	CSC					X	X		X		X		X
Coast Range newt	*Taricha torosa*	--	--	CSC					X					X		X
coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	--	--	CSC						X		X		X		X
coastal California gnatcatcher	*Polioptila californica californica*	FT	--	CSC		X		X		X	X	X		X		X
Coronado Island skink	*Plestiodon skiltonianus interparietalis*	--	--	CSC					X					X		X
Crissal thrasher	*Toxostoma crissale*	--	--	CSC	X											
Delhi Sands flower-loving fly	*Rhaphiomidas terminatus abdominalis*	FE	--	--		X				X				X		
desert pupfish	*Cyprinodon macularius*	FE	CE	--	X											
desert slender salamander	*Batrachoseps major aridus*	FE	CE	--	X							X	X			
desert tortoise	*Gopherus agassizii*	FT	CT	--	X		X									
Dulzura pocket mouse	*Chaetodipus californicus femoralis*	--	--	CSC	X	X			X	X		X	X	X		X
flat-tailed horned lizard	*Phrynosoma mcallii*	--	--	CSC	X											
golden eagle	*Aquila chrysaetos*	--	--	FP		X	X	X	X	X	X	X		X		X
grasshopper sparrow	*Ammodramus savannarum*	--	--	CSC				X						X		
Jacumba pocket mouse	*Perognathus longimembris internationalis*	--	--	CSC	X					X						
Kern primrose sphinx moth	*Euproserpinus euterpe*	FT	--	--				X								
Laguna Mountains skipper	*Pyrgus ruralis lagunae*	FE	--	--					X							
large-blotched salamander	*Ensatina klauberi*	--	--	CSC			X		X				X			
Le Conte's thrasher	*Toxostoma lecontei*	--	--	CSC	X	X	X									
least Bell's vireo	*Vireo bellii pusillus*	FE	CE	--	X	X	X		X	X	X	X		X		X
loggerhead shrike	*Lanius ludovicianus*	--	--	CSC	X	X				X		X				
long-eared owl	*Asio otus*	--	--	CSC	X		X			X				X		
Los Angeles pocket mouse	*Perognathus longimembris brevinasus*	--	--	CSC	X	X			X	X	X	X	X			
Mohave tui chub	*Siphateles bicolor mohavensis*	FE	CE	FP	X											
northern harrier	*Circus cyaneus*	--	--	CSC						X						
northern leopard frog	*Lithobates pipiens*	--	--	CSC		X								X		
northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*	--	--	CSC		X			X	X	X	X	X	X		X
orangethroat whiptail	*Aspidoscelis hyperythra*	--	--	CSC	X	X			X	X		X		X		X
pallid bat	*Antrozous pallidus*	--	--	CSC	X	X	X		X		X		X	X		X
pallid San Diego pocket mouse	*Chaetodipus fallax pallidus*	--	--	CSC	X	X	X		X		X	X	X			
Palm Springs pocket mouse	*Perognathus longimembris bangsi*	--	--	CSC	X		X									
Palm Springs round-tailed ground squirrel	*Xerospermophilus tereticaudus chlorus*	--	--	CSC	X	X										
peninsular bighorn sheep	*Ovis canadensis nelsoni DPS*	FE	CT	FP	X				X			X	X			
pocketed free-tailed bat	*Nyctinomops femorosaccus*	--	--	CSC	X	X			X	X	X			X		X
purple martin	*Progne subis*	--	--	CSC		X					X	X	X			X
quino checkerspot butterfly	*Euphydryas editha quino*	FE	--	--	X				X	X		X				X
red-diamond rattlesnake	*Crotalus ruber*	--	--	CSC	X	X	X			X	X	X	X	X		X
Riverside fairy shrimp	*Streptocephalus woottoni*	FE	--	--						X						X
San Bernardino flying squirrel	*Glaucomys sabrinus californicus*	--	--	CSC							X		X		X	
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	FE	--	CSC		X				X	X	X			X	
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*	--	--	CSC		X			X	X		X				X
San Diego desert woodrat	*Neotoma lepida intermedia*	--	--	CSC	X	X	X		X	X	X	X				X
San Diego fairy shrimp	*Branchinecta sandiegonensis*	FE	--	--										X		X
Santa Ana speckled dace	*Rhinichthys osculus ssp. 3*	--	--	CSC		X					X					
Santa Ana sucker	*Catostomus santaanae*	FT	--	CSC		X					X			X		
Sierra Madre yellow-legged frog	*Rana muscosa*	FE	CCE	CSC	X	X	X		X		X	X	X		X	
silvery legless lizard	*Anniella pulchra pulchra*	--	--	CSC	X	X		X								
south coast garter snake	*Thamnophis sirtalis ssp.*	--	--	CSC					X							
southern grasshopper mouse	*Onychomys torridus ramona*	--	--	CSC	X	X			X	X		X				
southern rubber boa	*Charina umbratica*	--	CT	--	X	X	X			X	X	X	X		X	
southern steelhead - southern California DPS	*Oncorhynchus mykiss irideus*	FE	--	CSC										X		
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	CE	--	X	X			X		X	X	X		X	X
Stephens' kangaroo rat	*Dipodomys stephensi*	FE	CT	--		X			X	X		X	X	X		X
summer tanager	*Piranga rubra*	--	--	CSC			X					X				
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	--	--	CSC				X								

Table I-15. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern California Mountains and Valleys Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection											
		FESA	CESA	Other DFG	Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Park	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X		X		X		X					X
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X				X		X		X		X
two-striped garter snake	*Thamnophis hammondii*	--	--	CSC	X	X		X	X		X	X		X	X	X
unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	FE	CE	FP	X			X							X	
vermilion flycatcher	*Pyrocephalus rubinus*	--	--	CSC	X		X									
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	--	--				X		X						
western mastiff bat	*Eumops perotis californicus*	--	--	CSC	X	X			X	X	X			X		X
western pond turtle	*Emys marmorata*	--	--	CSC				X	X	X		X		X		X
western red bat	*Lasiurus blossevillii*	--	--	CSC					X							X
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC						X						
western spadefoot	*Spea hammondii*	--	--	CSC		X				X		X		X		X
western yellow bat	*Lasiurus xanthinus*	--	--	CSC	X	X	X		X	X	X			X		X
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	CE	--		X				X				X		
white-eared pocket mouse	*Perognathus alticolus alticolus*	--	--	CSC							X				X	
white-tailed kite	*Elanus leucurus*	--	--	FP		X				X		X		X		X
yellow warbler	*Dendroica petechia brewsteri*	--	--	CSC	X	X	X			X	X	X				
yellow-blotched salamander	*Ensatina eschscholtzii croceator*	--	--	CSC				X								
yellow-breasted chat	*Icteria virens*	--	--	CSC	X	X	X			X				X		X
Natural Communities																
California Walnut Woodland	*California Walnut Woodland*	--	--	--		X								X		
Canyon Live Oak Ravine Forest	*Canyon Live Oak Ravine Forest*	--	--	--				X			X	X	X	X		
Coastal and Valley Freshwater Marsh	*Coastal and Valley Freshwater Marsh*	--	--	--		X										
Desert Fan Palm Oasis Woodland	*Desert Fan Palm Oasis Woodland*	--	--	--	X		X		X	X		X				
Mesquite Bosque	*Mesquite Bosque*	--	--	--	X		X									
Mojave Mixed Steppe	*Mojave Mixed Steppe*	--	--	--	X											
Mojave Riparian Forest	*Mojave Riparian Forest*	--	--	--	X		X									
Pebble Plains	*Pebble Plains*	--	--	--							X				X	
Riversidian Alluvial Fan Sage Scrub	*Riversidian Alluvial Fan Sage Scrub*	--	--	--		X				X	X					
Sonoran Cottonwood Willow Riparian Forest	*Sonoran Cottonwood Willow Riparian Forest*	--	--	--	X							X				
Southern California Arroyo Chub/Santa Ana Sucker Stream	*Southern California Arroyo Chub/Santa Ana Sucker Stream*	--	--	--		X								X		
Southern California Threespine Stickleback Stream	*Southern California Threespine Stickleback Stream*	--	--	--				X							X	
Southern Coast Live Oak Riparian Forest	*Southern Coast Live Oak Riparian Forest*	--	--	--		X		X		X		X	X	X		X
Southern Cottonwood Willow Riparian Forest	*Southern Cottonwood Willow Riparian Forest*	--	--	--		X		X		X		X	X	X		X
Southern Interior Basalt Flow Vernal Pool	*Southern Interior Basalt Flow Vernal Pool*	--	--	--										X		
Southern Interior Cypress Forest	*Southern Interior Cypress Forest*	--	--	--					X					X		X
Southern Mixed Riparian Forest	*Southern Mixed Riparian Forest*	--	--	--				X			X	X				
Southern Riparian Forest	*Southern Riparian Forest*	--	--	--	X	X		X		X				X		X
Southern Riparian Scrub	*Southern Riparian Scrub*	--	--	--		X		X		X						X
Southern Sycamore Alder Riparian Woodland	*Southern Sycamore Alder Riparian Woodland*	--	--	--		X		X		X	X	X		X		
Southern Willow Scrub	*Southern Willow Scrub*	--	--	--		X		X		X		X		X		
Valley Needlegrass Grassland	*Valley Needlegrass Grassland*	--	--	--				X						X		
Valley Oak Woodland	*Valley Oak Woodland*	--	--	--				X								
Walnut Forest	*Walnut Forest*	--	--	--										X		
Wildflower Field	*Wildflower Field*	--	--	--				X								

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):
- FE Endangered
- FT Threatened
- FPE Proposed Endangered
- FPT Proposed Threatened
- FC Candidate
- FD Delisted

California Endangered Species Act (CESA):
- CE Endangered
- CT Threatened
- CR Rare
- CCE Candidate Endangered
- CD Delisted

Other California Department of Fish and Game (DFG):
- FP Fully Protected under the California Fish and Game Code
- CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
- California Rare Plant Rank (CRPR):
  - *List 1A Plants Presumed Extinct in California*
  - *List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 2 Plants Rare, Threatened, or Endangered in California, but More Common Elsewhere*
    - 0.1 Seriously threatened in California (high degree/immediacy of threat)
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
  - *List 4 Plants of Limited Distribution - A Watch List*
    - 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
    - 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Table I-16. Known Occurrences of Special-Status Species in Ecological Sections and Subsections

Southern Cascades Section

Common Name	Scientific Name	Status[1]			USFS Ecological Subsection	
		FESA	CESA	Other DFG	Hat Creek Rim	Medicine Lake Lava Flows
Plants						
Aleppo avens	*Geum aleppicum*	--	--	2.2	X	
Bebb's willow	*Salix bebbiana*	--	--	2.3		X
Bellinger's meadowfoam	*Limnanthes floccosa ssp. bellingeriana*	--	--	1B.2	X	
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	--	CE	1B.2	X	X
bristly sedge	*Carex comosa*	--	--	2.1	X	
Columbia yellow cress	*Rorippa columbiae*	--	--	1B.2		X
cream-flowered bladderwort	*Utricularia ochroleuca*	--	--	2.2		X
doublet	*Dimeresia howellii*	--	--	2.3		X
eel-grass pondweed	*Potamogeton zosteriformis*	--	--	2.2	X	
Engelmann spruce	*Picea engelmannii*	--	--	2.2	X	
English Peak greenbrier	*Smilax jamesii*	--	--	1B.3	X	X
English sundew	*Drosera anglica*	--	--	2.3	X	
ephemeral monkeyflower	*Mimulus evanescens*	--	--	1B.2		X
flat-leaved bladderwort	*Utricularia intermedia*	--	--	2.2		X
Great Basin nemophila	*Nemophila breviflora*	--	--	2.3	X	
Greene's tuctoria	*Tuctoria greenei*	FE	CR	1B.1	X	
Howell's thelypodium	*Thelypodium howellii ssp. howellii*	--	--	1B.2	X	
Klamath fawn lily	*Erythronium klamathense*	--	--	2.2	X	X
Lemmon's milk-vetch	*Astragalus lemmonii*	--	--	1B.2	X	X
little hulsea	*Hulsea nana*	--	--	2.3		X
little ricegrass	*Oryzopsis exigua*	--	--	2.3		X
long-haired star-tulip	*Calochortus longebarbatus var. longebarbatus*	--	--	1B.2	X	X
long-leaved starwort	*Stellaria longifolia*	--	--	2.2	X	X
long-stiped campion	*Silene occidentalis ssp. longistipitata*	--	--	1B.2	X	
marsh skullcap	*Scutellaria galericulata*	--	--	2.2	X	X
Modoc County knotweed	*Polygonum polygaloides ssp. esotericum*	--	--	1B.1	X	X
Newberry's cinquefoil	*Potentilla newberryi*	--	--	2.3		X
northern clarkia	*Clarkia borealis ssp. borealis*	--	--	1B.3	X	
playa phacelia	*Phacelia inundata*	--	--	1B.3		X
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	--	--	1B.1	X	
scabrid alpine tarplant	*Anisocarpus scabridus*	--	--	1B.3	X	
slender Orcutt grass	*Orcuttia tenuis*	FT	CE	1B.1	X	X
slender-leaved pondweed	*Stuckenia filiformis*	--	--	2.2	X	
squarestem phlox	*Phlox muscoides*	--	--	2.3		X
squashberry	*Viburnum edule*	--	--	2.1	X	
Tracy's eriastrum	*Eriastrum tracyi*	--	CR	1B.2	X	
tufted loosestrife	*Lysimachia thyrsiflora*	--	--	2.3	X	
watershield	*Brasenia schreberi*	--	--	2.3	X	
Wildlife						
American badger	*Taxidea taxus*	--	--	CSC	X	
American white pelican	*Pelecanus erythrorhynchos*	--	--	CSC		X
bald eagle	*Haliaeetus leucocephalus*	FD	CE	FP	X	X
bank swallow	*Riparia riparia*	--	CT	--	X	X
bigeye marbled sculpin	*Cottus klamathensis macrops*	--	--	CSC	X	X
black swift	*Cypseloides niger*	--	--	CSC	X	
bull trout	*Salvelinus confluentus*	FT	CE	--	X	
California wolverine	*Gulo gulo*	FC	CT	FP	X	X
Cascades frog	*Rana cascadae*	--	--	CSC	X	
foothill yellow-legged frog	*Rana boylii*	--	--	CSC	X	
golden eagle	*Aquila chrysaetos*	--	--	FP		X
greater sage-grouse	*Centrocercus urophasianus*	FC	--	CSC		X
greater sandhill crane	*Grus canadensis tabida*	--	CT	FP	X	X
hardhead	*Mylopharodon conocephalus*	--	--	CSC	X	
Lost River sucker	*Deltistes luxatus*	FE	CE	FP		X
McCloud River redband trout	*Oncorhynchus mykiss ssp. 2*	--	--	CSC	X	
northern goshawk	*Accipiter gentilis*	--	--	CSC	X	X
northern spotted owl	*Strix occidentalis caurina*	FT	--	CSC	X	X
Oregon snowshoe hare	*Lepus americanus klamathensis*	--	--	CSC	X	
Oregon spotted frog	*Rana pretiosa*	FC	--	CSC		X
Pacific fisher	*Martes pennanti (pacifica) DPS*	FC	--	CSC	X	X
Pacific tailed frog	*Ascaphus truei*	--	--	CSC	X	
pallid bat	*Antrozous pallidus*	--	--	CSC		X
Pit roach	*Lavinia symmetricus mitrulus*	--	--	CSC	X	
purple martin	*Progne subis*	--	--	CSC	X	
rough sculpin	*Cottus asperrimus*	--	CT	FP	X	X
Shasta crayfish	*Pacifastacus fortis*	FE	CE	--	X	X
shortnose sucker	*Chasmistes brevirostris*	FE	CE	FP		X
Sierra Nevada red fox	*Vulpes vulpes necator*	--	CT	--	X	
Swainson's hawk	*Buteo swainsoni*	--	CT	--		X
Townsend's big-eared bat	*Corynorhinus townsendii*	--	--	CSC	X	X
tricolored blackbird	*Agelaius tricolor*	--	--	CSC	X	X
western pond turtle	*Emys marmorata*	--	--	CSC	X	
western snowy plover	*Charadrius alexandrinus nivosus*	FT	--	CSC		X
western spadefoot	*Spea hammondii*	--	--	CSC		X
willow flycatcher	*Empidonax traillii*	--	CE	--	X	

Table I-16. Known Occurrences of Special-Status Species in Ecological Sections and Subsections *Southern Cascades Section*						
Common Name	Scientific Name	Status[1]			USFS Ecological Subsection	
		FESA	CESA	Other DFG	Hat Creek Rim	Medicine Lake Lava Flows
Natural Communities						
Big Lake	*Big Lake*	--	--	--	X	X
Lower McCloud River/Canyon River	*Lower McCloud River/Canyon River*	--	--	--	X	
Lower Pit River/Canyon River (Hardhead/Tule Perch River)	*Lower Pit River/Canyon River (Hardhead/Tule Perch River)*	--	--	--	X	
Northern Basalt Flow Vernal Pool	*Northern Basalt Flow Vernal Pool*	--	--	--	X	X
Northern Interior Cypress Forest	*Northern Interior Cypress Forest*	--	--	--		X
Pit R. Drainage Rough Sculpin/Shasta Crayfish Spring Stream	*Pit R. Drainage Rough Sculpin/Shasta Crayfish Spring Stream*	--	--	--	X	X
Pit River Drainage Speckled Dace/Pit Sculpin Stream	*Pit River Drainage Speckled Dace/Pit Sculpin Stream*	--	--	--	X	X
Pit River Drainage Squawfish/Sucker Valley Stream	*Pit River Drainage Squawfish/Sucker Valley Stream*	--	--	--	X	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed
* CNDDB Occurrences supplemented by California Wildlife Habitat Relationships species ranges
** CNDDB Occurrences associated to nearest
[1] Status definitions:

Federal Endangered Species Act (FESA):
FE Endangered
FT Threatened
FPE Proposed Endangered
FPT Proposed Threatened
FC Candidate
FD Delisted

California Endangered Species Act (CESA):
CE Endangered
CT Threatened
CR Rare
CCE Candidate Endangered
CD Delisted

Other California Department of Fish and Game (DFG):
FP Fully Protected under the California Fish and Game Code
CSC Considered California species of special concern by DFG (no formal protection other than CEQA consideration)
California Rare Plant Rank (CRPR):
List 1A Plants Presumed Extinct in California
List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere
0.1 Seriously threatened in California (high degree/immediacy of threat)
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0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)
List 4 Plants of Limited Distribution - A Watch List
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Source: CNDDB 2011; CA State Parks 2010; USFS 1997.

Appendix J

USFWS Critical Habitat in Ecological Sections and Subsections

Table J-1a. USFWS Critical Habitat in Ecological Sections and Subsections

Central California Coast Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection								
		FESA	East Bay Hills-Mt. Diablo	Leeward Hills	North Coastal Santa Lucia Range	Santa Clara Valley	Santa Cruz Mountains	Santa Maria Valley	South Coastal Santa Lucia Range	Suisun Hills and Valleys	Watsonville Plain-Salinas Valley
Plants											
Contra Costa goldfields	*Lasthenia conjugens*	FE	X							X	
La Graciosa thistle	*Cirsium loncholepis*	FE						X			
Monterey spineflower	*Chorizanthe pungens var. pungens*	FT			X						X
robust (incl. Scotts Valley) spineflower	*Chorizanthe robusta (incl. vars. robusta and hartwegii)*	FE					X				X
Santa Cruz tarplant	*Holocarpha macradenia*	FT	X				X				X
Scotts Valley polygonum	*Polygonum hickmanii*	FE					X				
Scott's Valley spineflower	*Chorizanthe robusta hartwegii*	FT					X				
Yadon's piperia	*Piperia yadonii*	FE			X						X
Wildlife											
Alameda whipsnake (=striped racer)	*Masticophis lateralis euryxanthus*	FT	X							X	
arroyo (=arroyo southwestern) toad	*Bufo californicus (=microscaphus)*	FE						X			
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT		X		X	X				
California red-legged frog	*Rana draytonii*	FT	X	X	X	X	X	X	X	X	X
California tiger salamander	*Ambystoma californiense*	FT		X	X	X		X			
Conservancy fairy shrimp	*Branchinecta conservatio*	FE								X	
Delta smelt	*Hypomesus transpacificus*	FT								X	
green sturgeon (southern DPS)	*Acipenser medirostris*	FT	X	X		X				X	
marbled murrelet	*Brachyramphus marmoratus*	FT					X				X
Morro Bay kangaroo rat	*Dipodomys heermanni morroensis*	FE							X		
Morro shoulderband (=Banded dune) snail	*Helminthoglypta walkeriana*	FE							X		
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X	X	X	X	X	X	X	X	X
Steller sea-lion	*Eumetopias jubatus*	FE					X				
tidewater goby	*Eucyclogobius newberryi*	FE					X	X	X		X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT								X	
vernal pool tadpole shrimp	*Lepidurus packardi*	FE								X	
western snowy plover	*Charadrius alexandrinus nivosus*	FT			X		X		X		X
Zayante band-winged grasshopper	*Trimerotropis infantilis*	FE					X				

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

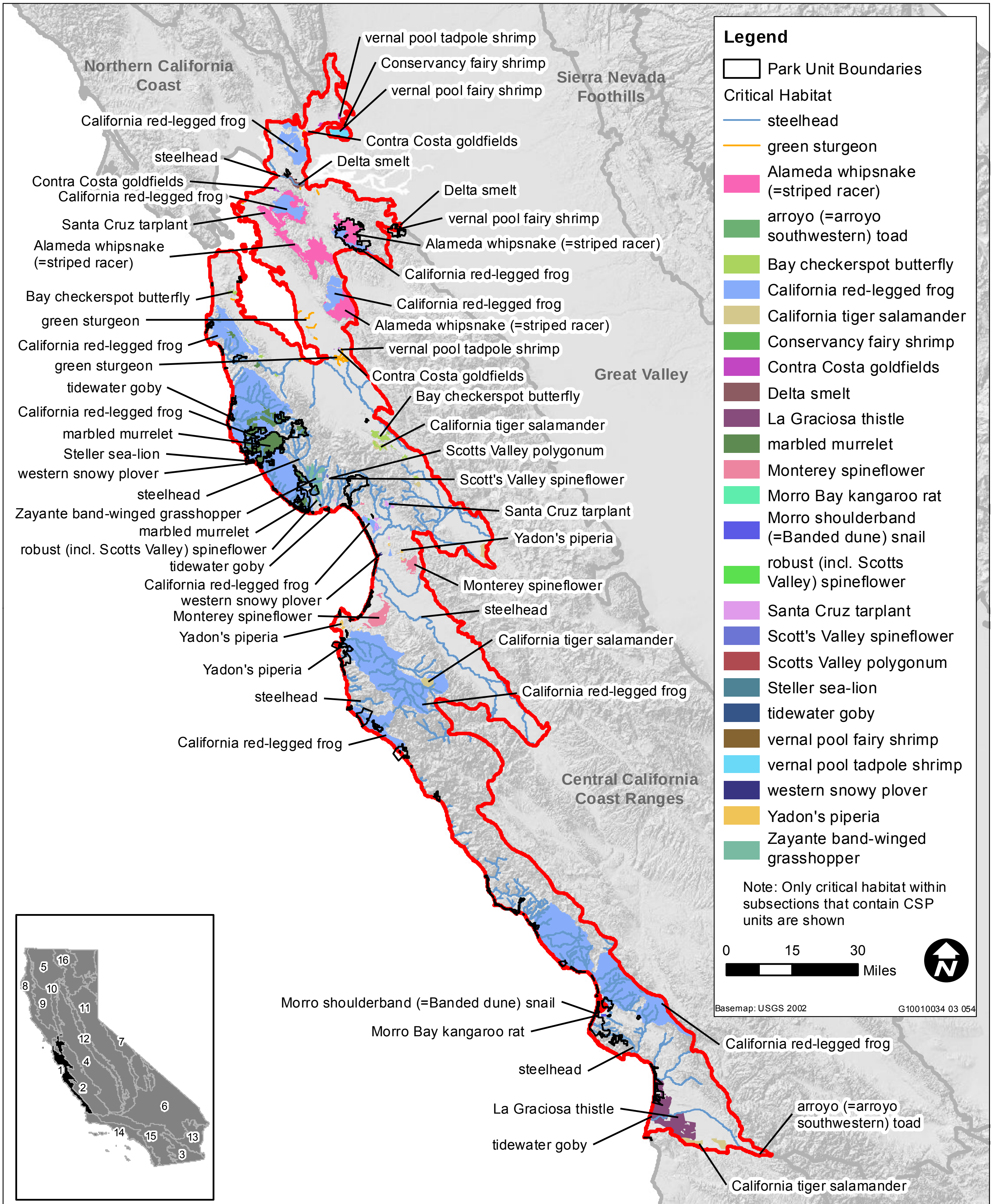
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-1b

Central California Coast - USFWS Critical Habitat and California State Park Units

ASCENT ENVIRONMENTAL

Table J-2a. USFWS Critical Habitat in Ecological Sections and Subsections

Central California Coast Ranges Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection				
		FESA	Diablo Range	Eastern Hills	Fremont-Livermore Hills and Valleys	Gabilan Range	Western Diablo Range
Plants							
Contra Costa goldfields	*Lasthenia conjugens*	FE		X	X		
large-flowered fiddleneck	*Amsinckia grandiflora*	FE		X			
Wildlife							
Alameda whipsnake (=striped racer)	*Masticophis lateralis euryxanthus*	FT	X	X	X		X
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT			X		
California red-legged frog	*Rana draytonii*	FT	X	X	X	X	X
California tiger salamander	*Ambystoma californiense*	FT	X	X	X	X	X
Delta smelt	*Hypomesus transpacificus*	FT		X			
longhorn fairy shrimp	*Branchinecta longiantenna*	FE		X			
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X		X	X	X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	X	X	X	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

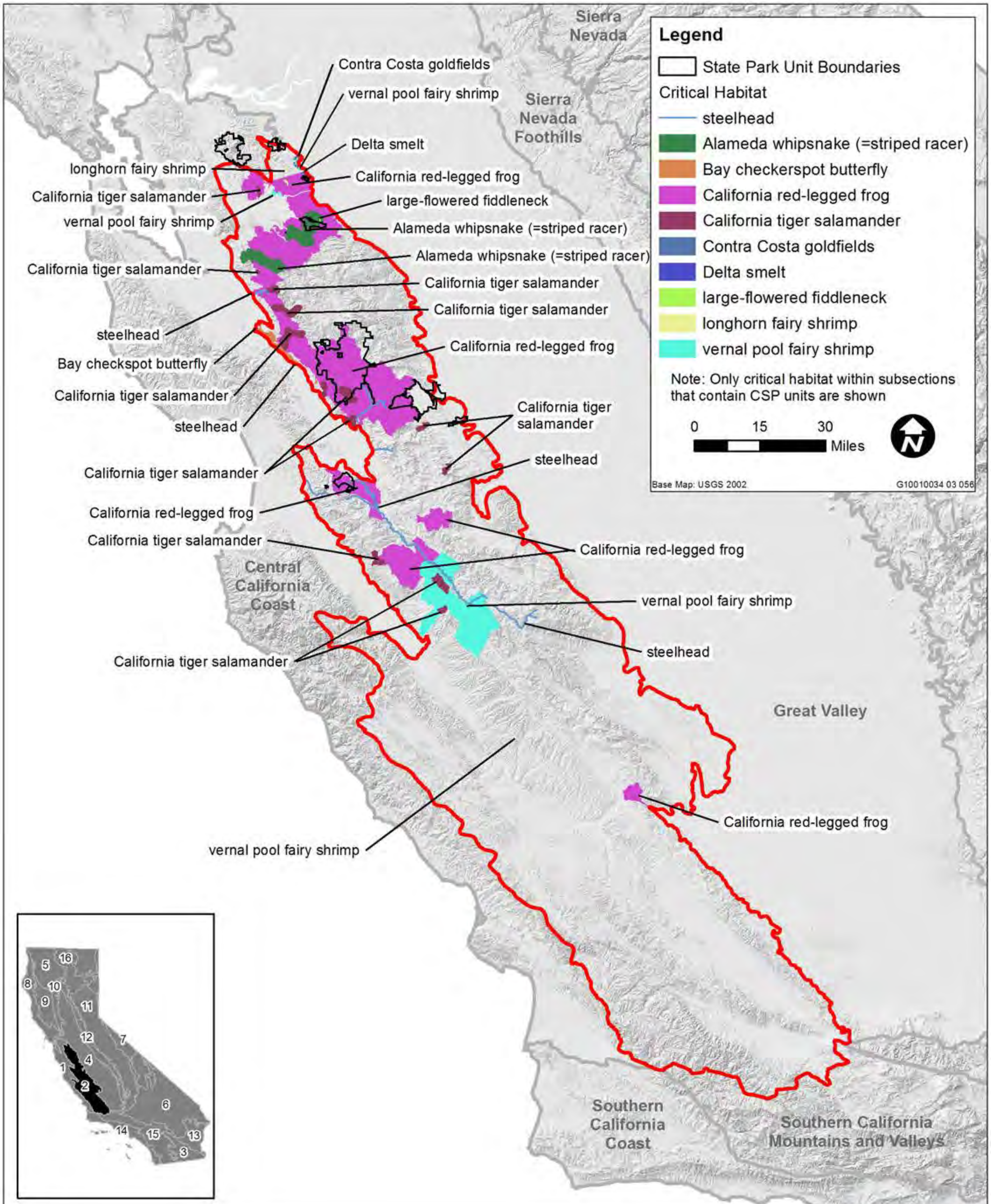
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-2b Central California Coast Ranges - USFWS Critical Habitat and California State Park Units

ASCENT ENVIRONMENTAL

Table J-3a. USFWS Critical Habitat in Ecological Sections and Subsections

Colorado Desert Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection		
		FESA	Borrego Valley-West Mesa	Coachella Valley	Imperial Valley
Wildlife					
Coachella Valley fringe-toed lizard	*Uma inornata*	FT		X	
desert pupfish	*Cyprinodon macularius*	FE	X		
desert tortoise	*Gopherus agassizii*	FT		X	
peninsular bighorn sheep	*Ovis canadensis nelsoni*	FE	X	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

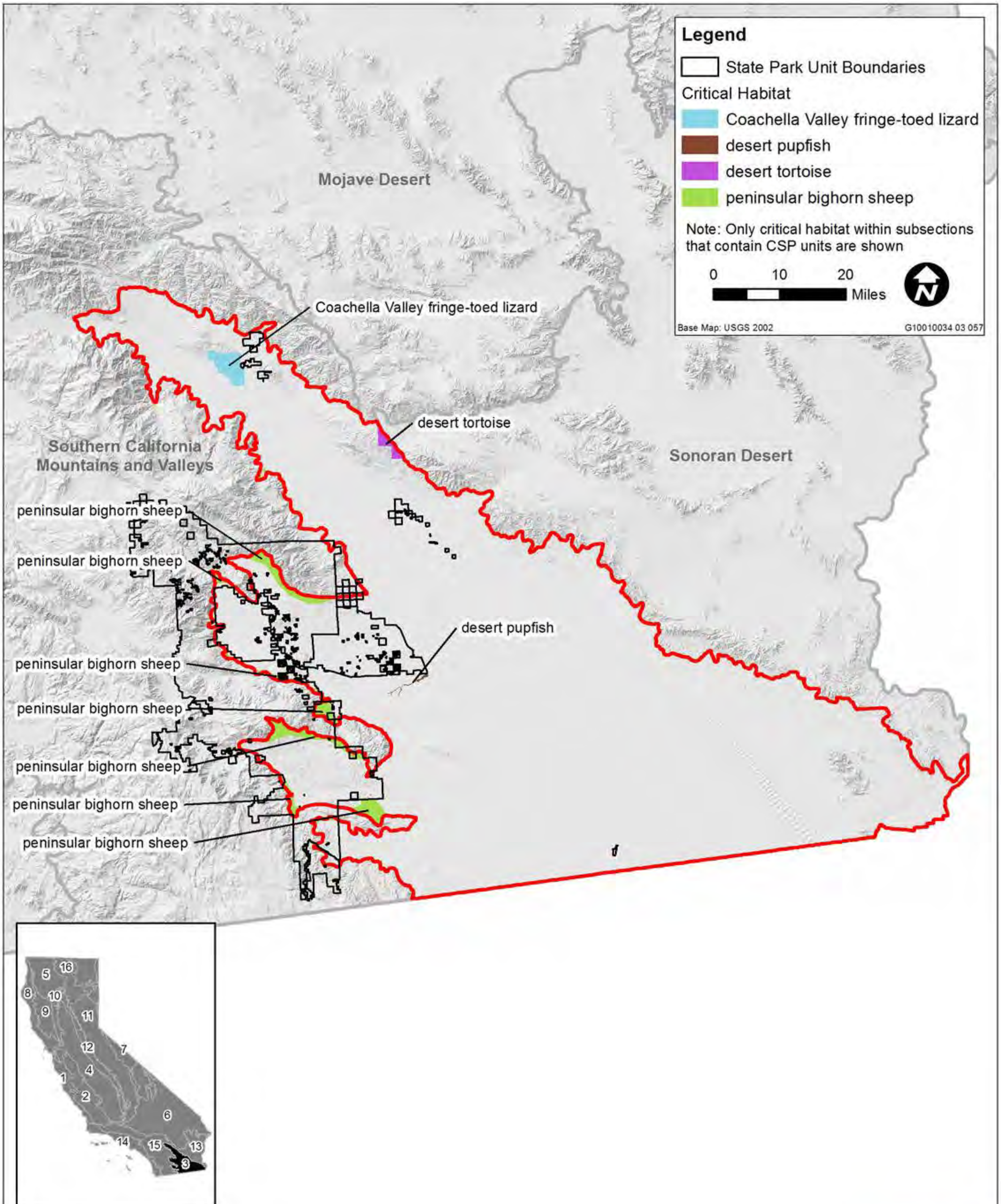
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-3b

Colorado Desert - USFWS Critical Habitat and California State Park Units

ASCENT ENVIRONMENTAL

Table J-4a. USFWS Critical Habitat in Ecological Sections and Subsections

Great Valley Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection													
		FESA	Butte Sink-Sutter Basin	Camanche Terraces	Delta	Granitic Alluvial Fans and Terraces	Hardpan Terraces	Manteca-Merced Alluvium	North Valley Alluvium	River Alluvium	San Joaquin Basin	Sodic Claypan Terraces	South Valley Alluvium and Basins	Tulare Basin	Westside Alluvial Fans and Terraces	Yolo-American Basins
Plants																
Antioch Dunes evening-primrose	*Oenothera deltoides ssp. howellii*	FE			X										X	
Butte County meadowfoam	*Limnanthes floccosa ssp. californica*	FE	X				X		X							
Colusa grass	*Neostapfia colusana*	FT		X			X	X			X					
Contra Costa goldfields	*Lasthenia conjugens*	FE			X							X			X	
Contra Costa wallflower	*Erysimum capitatum var. angustatum*	FE			X										X	
fleshy owl's-clover	*Castilleja campestris ssp. succulenta*	FT		X		X	X	X								
Greene's tuctoria	*Tuctoria greenei*	FE		X			X	X	X							
hairy Orcutt grass	*Orcuttia pilosa*	FE		X			X		X							
Hoover's spurge	*Chamaesyce hooveri*	FT		X		X	X	X	X		X					
Sacramento Orcutt grass	*Orcuttia viscida*	FE		X			X									
San Joaquin Orcutt grass	*Orcuttia inaequalis*	FT		X		X	X	X								
slender Orcutt grass	*Orcuttia tenuis*	FT					X		X							
Wildlife																
Buena Vista Lake ornate shrew	*Sorex ornatus relictus*	FE											X			
California condor	*Gymnogyps californianus*	FE					X						X			
California red-legged frog	*Rana draytonii*	FT		X	X										X	
California tiger salamander	*Ambystoma californiense*	FT		X		X	X	X				X				
chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	FT	X		X		X		X	X		X				X
Conservancy fairy shrimp	*Branchinecta conservatio*	FE		X	X		X	X	X		X	X				
Delta green ground beetle	*Elaphrus viridis*	FT										X				
Delta smelt	*Hypomesus transpacificus*	FT			X		X	X				X			X	X
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	FE				X										
green sturgeon (southern DPS)	*Acipenser medirostris*	FT			X		X		X	X		X			X	X
longhorn fairy shrimp	*Branchinecta longiantenna*	FE									X					
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X	X	X		X	X	X	X	X	X			X	X
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT					X									X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT		X	X	X	X	X	X		X	X	X	X	X	
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	X	X	X	X	X	X	X	X	X	X				

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

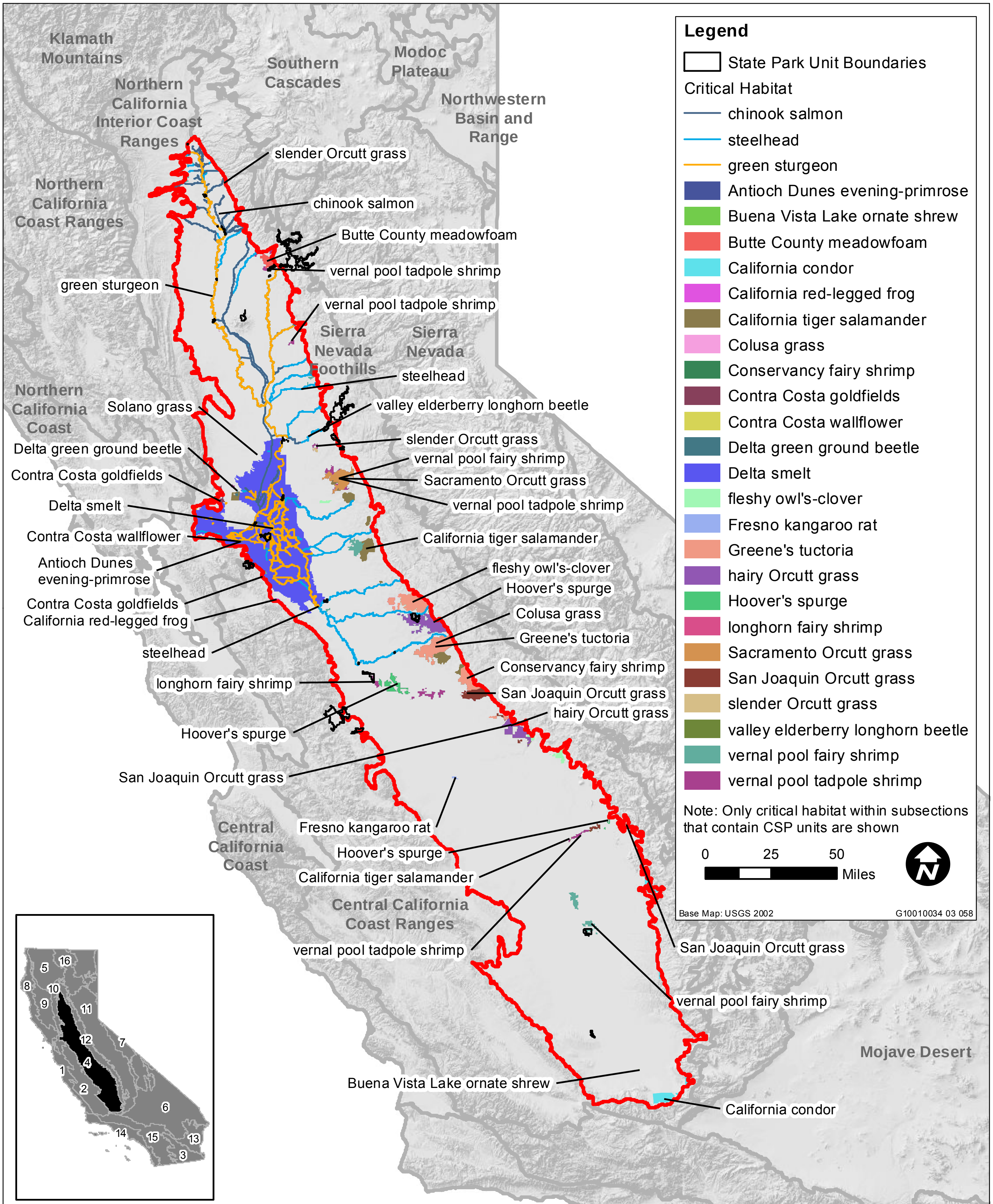
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-4b

Great Valley - USFWS Critical Habitat and California State Park Units

Table J-5a. USFWS Critical Habitat in Ecological Sections and Subsections

Klamath Mountains Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection				
		FESA	Eastern Klamath Mountains	Gasquet Mountains Ultramafics	Oregon Mountains	Upper Scott Mountains	Western Jurassic
Wildlife							
chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	FT	X		X		
green sturgeon (southern DPS)	*Acipenser medirostris*	FT	X				
marbled murrelet	*Brachyramphus marmoratus*	FT		X			X
northern spotted owl	*Strix occidentalis caurina*	FT	X	X	X	X	X
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X		X		

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

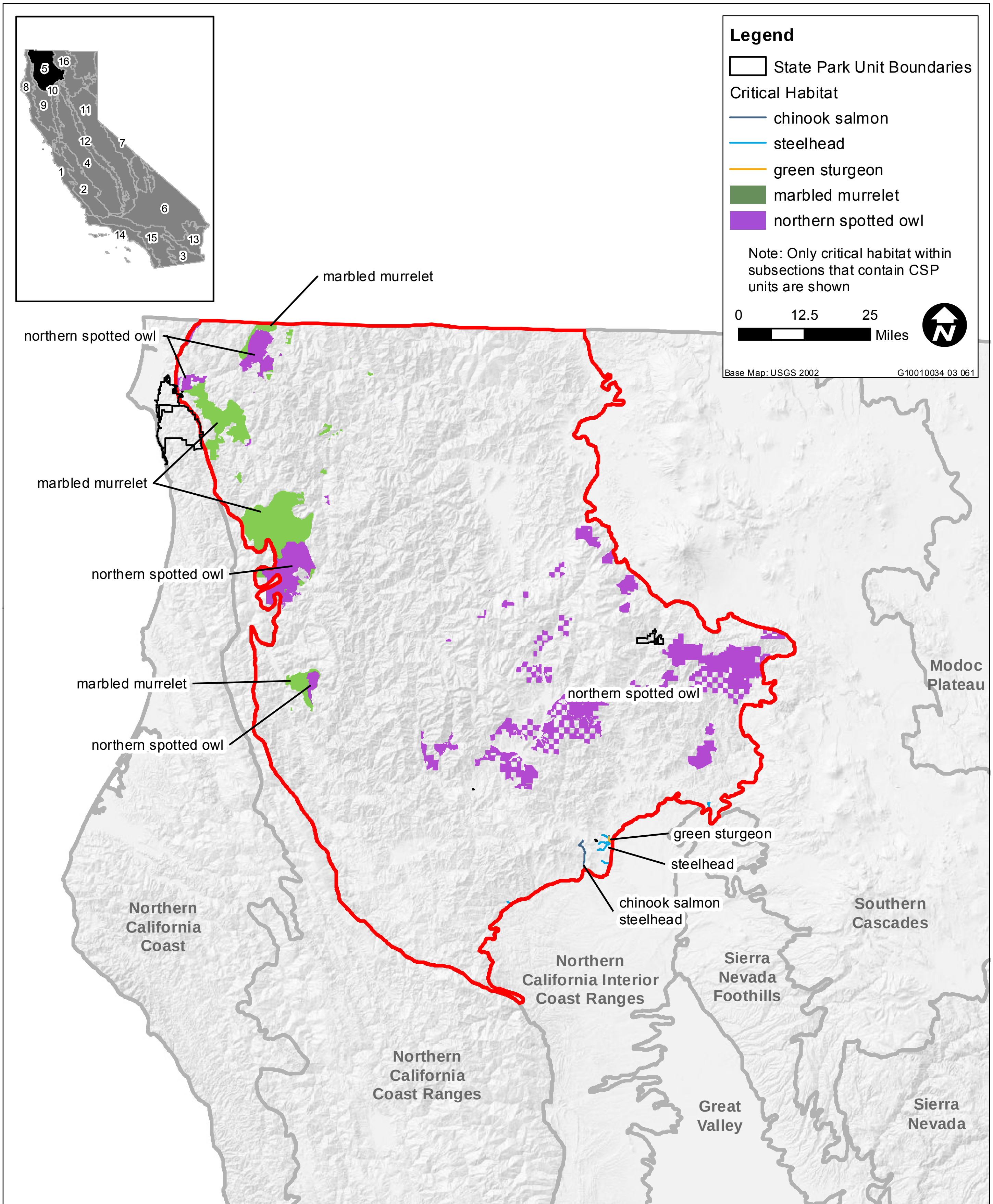
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-5b

Klamath Mountains - USFWS Critical Habitat and California State Park Units

Table J-6a. USFWS Critical Habitat in Ecological Sections and Subsections

Mojave Desert Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection		
		FESA	High Desert Plains and Hills	Providence Mountains-Lanfair Valley	Searles Valley-Owlshead Mountains
Wildlife					
arroyo (=arroyo southwestern) toad	*Bufo californicus (=microscaphus)*	FE	X		
California condor	*Gymnogyps californianus*	FE	X		
desert tortoise	*Gopherus agassizii*	FT	X	X	
Inyo California towhee	*Pipilo crissalis eremophilus*	FT			X
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	X		

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

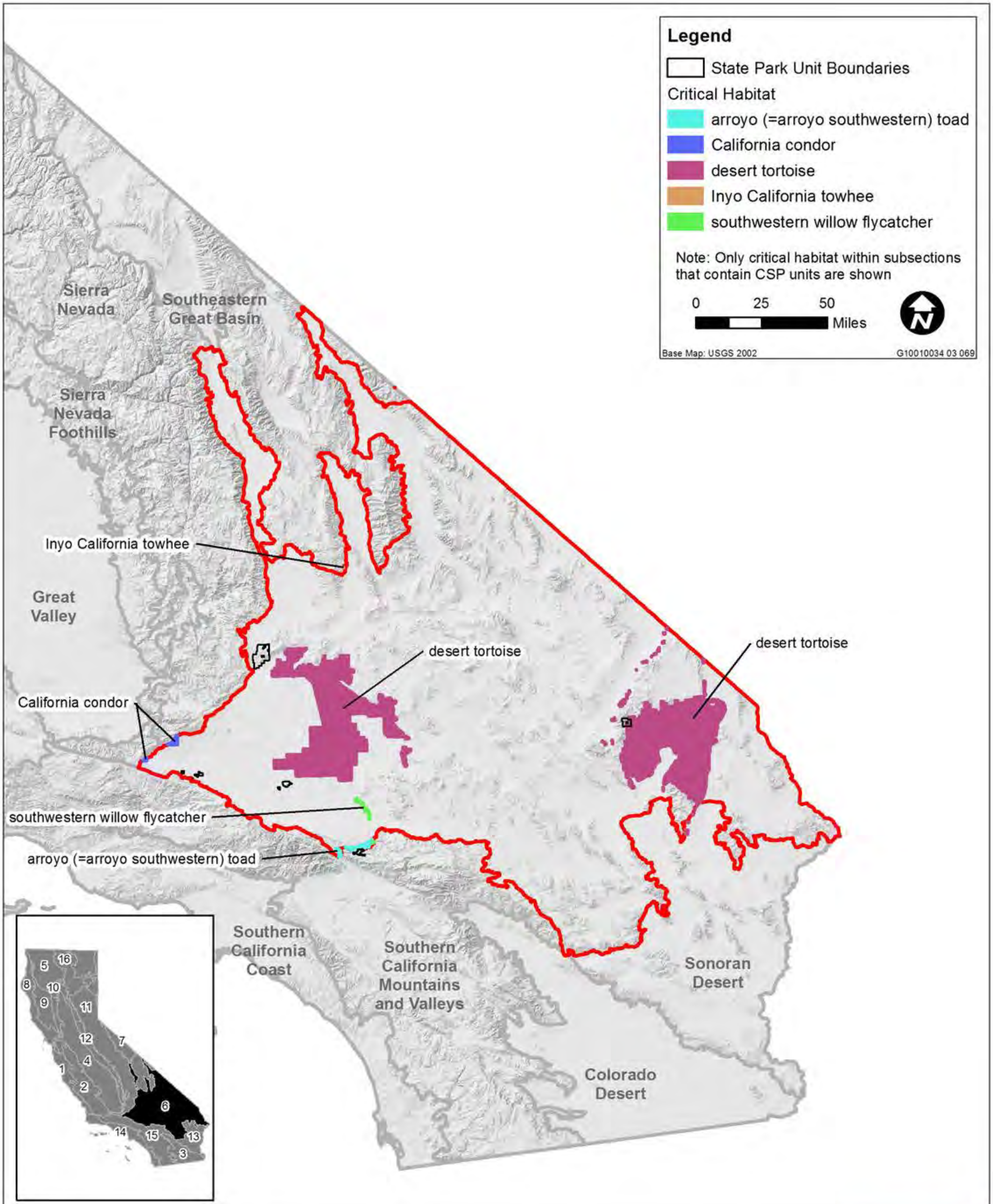
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-6b Mojave Desert - USFWS Critical Habitat and California State Park Units

Table J-7a. USFWS Critical Habitat in Ecological Sections and Subsections *Mono Section*				
Common Name	Scientific Name	Status[1]	USFS Ecological Subsection	
		FESA	Bodie Hills-Excelsior Mountains	Mono Valley
Wildlife				
Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*	FE	X	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

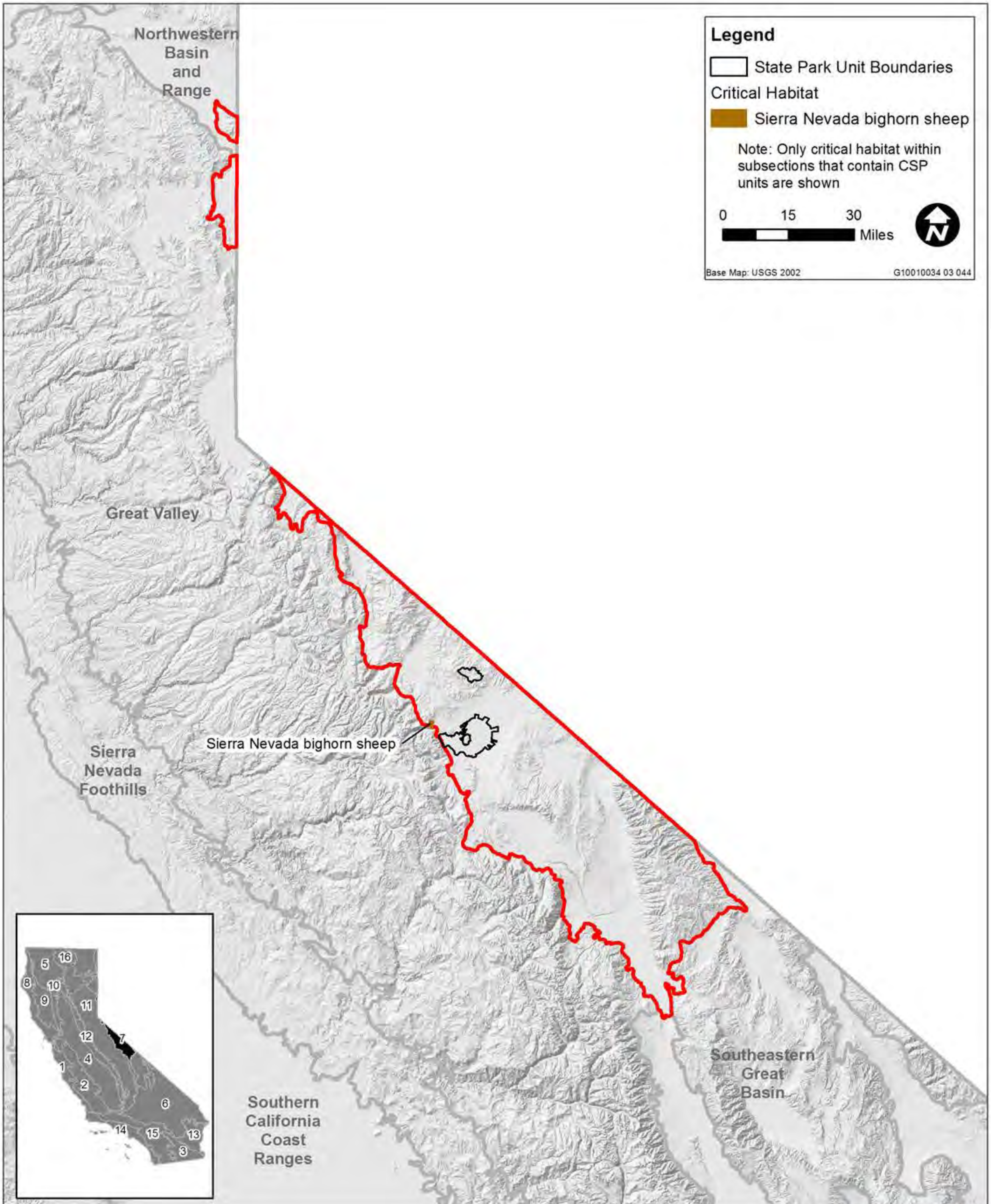
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-7b

Mono - USFWS Critical Habitat and California State Park Units

Table J-8a. USFWS Critical Habitat in Ecological Sections and Subsections

Northern California Coast Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection							
		FESA	Central Franciscan	Coastal Franciscan	Coastal Hills-Santa Rosa Plain	Humboldt Bay Flats and Terraces	Marin Hills and Valleys	Mount St. Helena Flows and Valleys	Northern Franciscan	Wiregrass Ridge
Plants										
Baker's larkspur	*Delphinium bakeri*	FE		X			X			
Contra Costa goldfields	*Lasthenia conjugens*	FE		X				X		
Kneeland Prairie penny-cress	*Thlaspi californicum*	FE	X							
yellow larkspur	*Delphinium luteum*	FE			X		X			
Wildlife										
California red-legged frog	*Rana draytonii*	FT		X	X		X	X		
chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	FT	X	X	X	X			X	X
green sturgeon (southern DPS)	*Acipenser medirostris*	FT			X	X	X	X		
marbled murrelet	*Brachyramphus marmoratus*	FT	X	X		X	X		X	X
northern spotted owl	*Strix occidentalis caurina*	FT	X	X					X	
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT		X	X		X	X		
Steller sea-lion	*Eumetopias jubatus*	FE		X			X			
tidewater goby	*Eucyclogobius newberryi*	FE	X	X	X	X	X		X	X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT						X		
western snowy plover	*Charadrius alexandrinus nivosus*	FT	X	X		X	X		X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

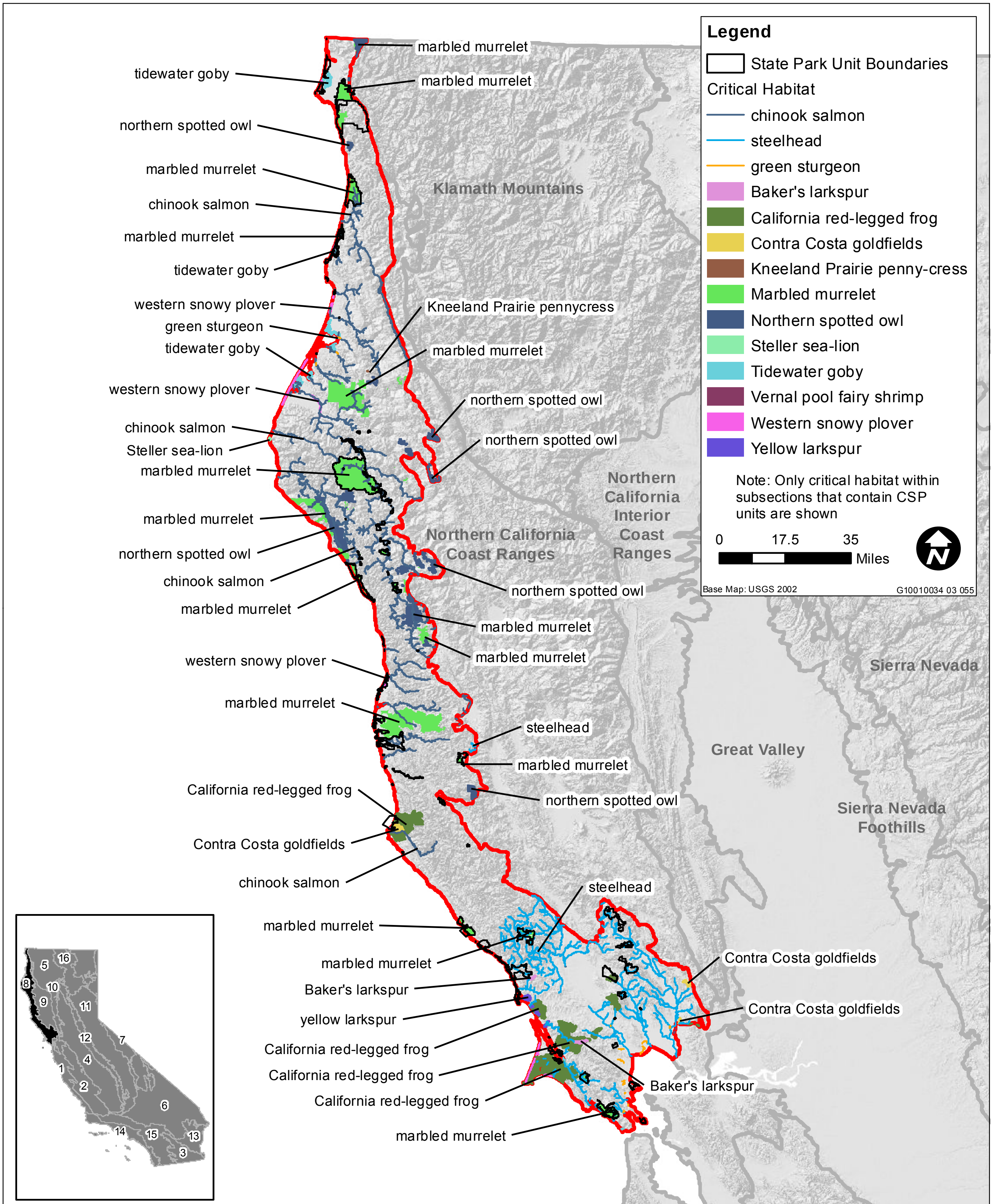
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-8b. Northern California Coast - USFWS Critical Habitat and California State Park Units

Table J-9a. USFWS Critical Habitat in Ecological Sections and Subsections

Northern California Coast Ranges Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection	
		FESA	Central Franciscan	Clear Lake Hills and Valleys
Plants				
slender Orcutt grass	*Orcuttia tenuis*	FT	X	
Wildlife				
chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	FT	X	
marbled murrelet	*Brachyramphus marmoratus*	FT	X	
northern spotted owl	*Strix occidentalis caurina*	FT	X	
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

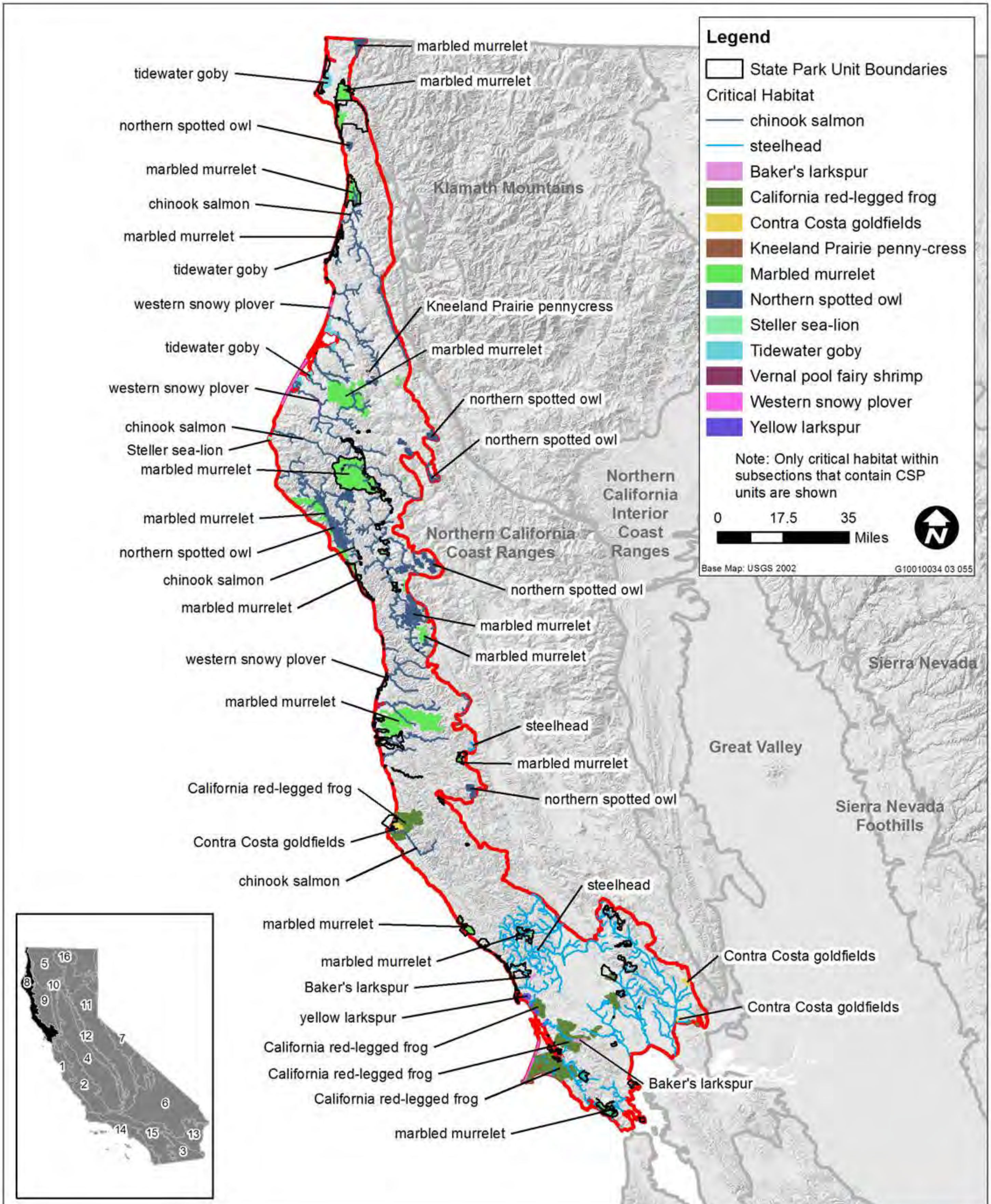
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-9b Northern California Coast Ranges - USFWS Critical Habitat and California State Park Units

Table J-10a. USFWS Critical Habitat in Ecological Sections and Subsections

Northern California Interior Coast Ranges Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection
		FESA	Tehama Terraces
Plants			
slender Orcutt grass	*Orcuttia tenuis*	FT	X
Wildlife			
chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	FT	X
green sturgeon (southern DPS)	*Acipenser medirostris*	FT	X
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	X
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

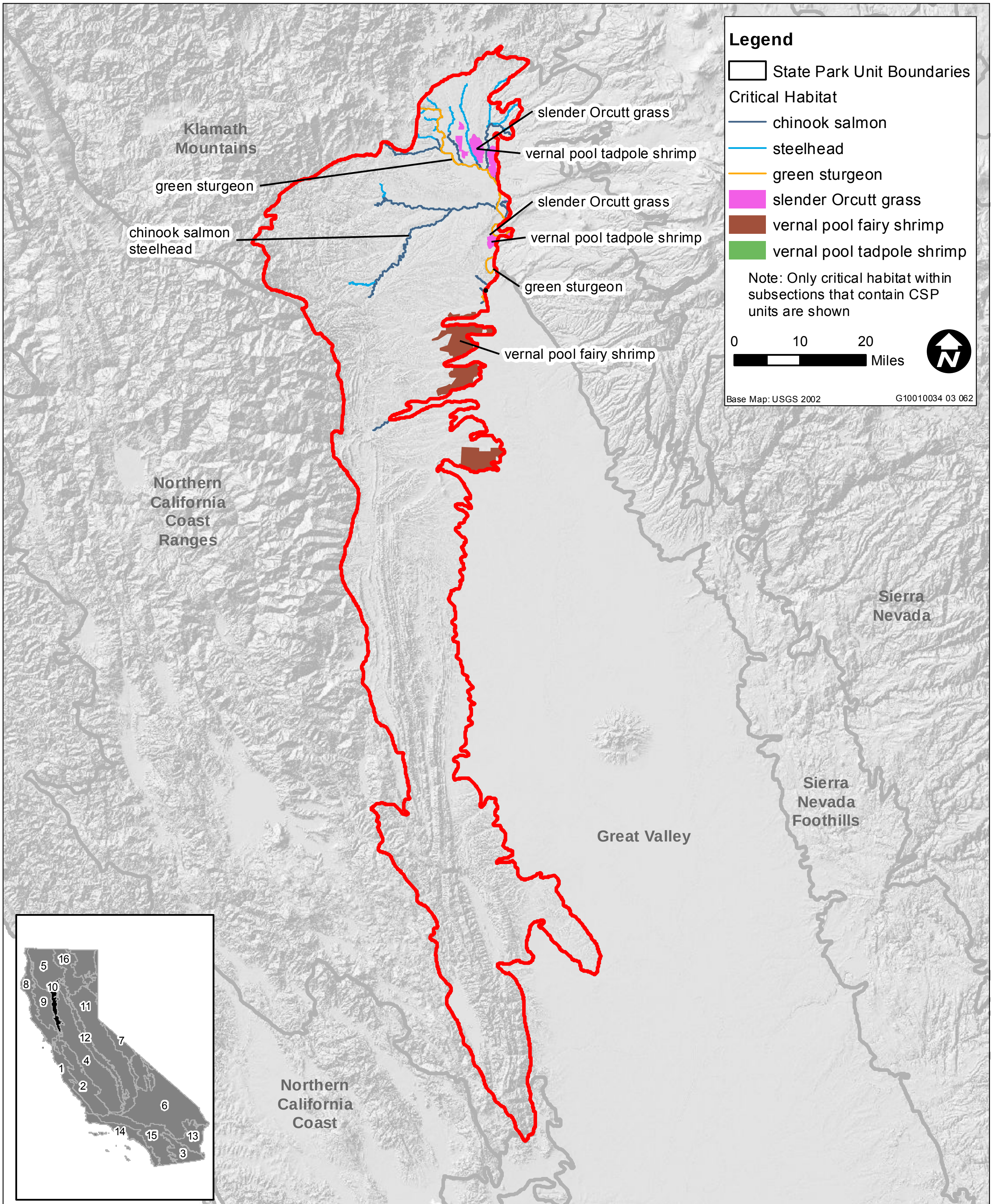
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-10b

Northern California Interior Coast Ranges - USFWS Critical Habitat and California State Park Units

Table J-11a. USFWS Critical Habitat in Ecological Sections and Subsections

Sierra Nevada Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection									
		FESA	Batholith and Volcanic Flows	Eastern Slopes	Glaciated Batholith and Volcanic Flows	Granitic and Metamorphic Foothills	Greenville-Graeagle	Tahoe Valley	Tahoe-Truckee	Tehachapi-Piute Mountains	Upper Batholith and Volcanic Flows	Upper Foothills Metamorphic Belt
Wildlife												
California condor	*Gymnogyps californianus*	FE	X		X							
California red-legged frog	*Rana draytonii*	FT		X		X						
Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*	FE	X									
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	X									

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

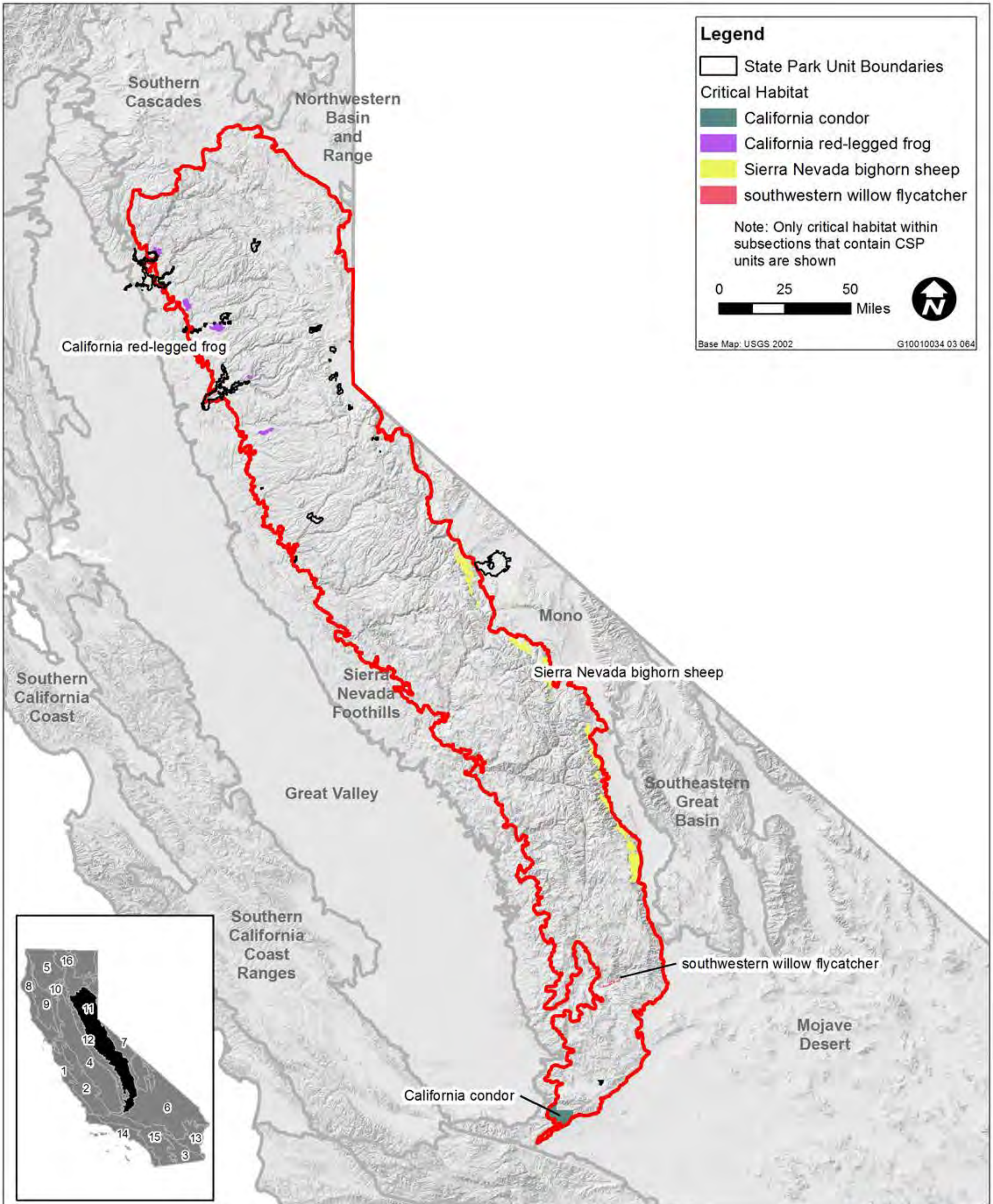
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-11b

Sierra Nevada - USFWS Critical Habitat and California State Park Units

Table J-12a. USFWS Critical Habitat in Ecological Sections and Subsections

Sierra Nevada Foothills Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection		
		FESA	Lower Foothills Metamorphic Belt	Lower Granitic Foothills	San Emigdio Mountains
Plants					
Colusa grass	*Neostapfia colusana*	FT	X		
fleshy owl's-clover	*Castilleja campestris ssp. succulenta*	FT	X	X	
Greene's tuctoria	*Tuctoria greenei*	FE	X		
hairy Orcutt grass	*Orcuttia pilosa*	FE	X	X	
Hoover's spurge	*Chamaesyce hooveri*	FT	X	X	
Keck's checker-mallow	*Sidalcea keckii*	FE		X	
San Joaquin Orcutt grass	*Orcuttia inaequalis*	FT	X	X	
Wildlife					
California condor	*Gymnogyps californianus*	FE		X	X
California red-legged frog	*Rana draytonii*	FT	X		
California tiger salamander	*Ambystoma californiense*	FT	X	X	
chinook salmon	*Oncorhynchus (=Salmo) tshawytscha*	FT	X		
Conservancy fairy shrimp	*Branchinecta conservatio*	FE	X		
steelhead	*Oncorhynchus (=Salmo) mykiss*	FT	X		
vernal pool fairy shrimp	*Branchinecta lynchi*	FT	X	X	
vernal pool tadpole shrimp	*Lepidurus packardi*	FE	X	X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

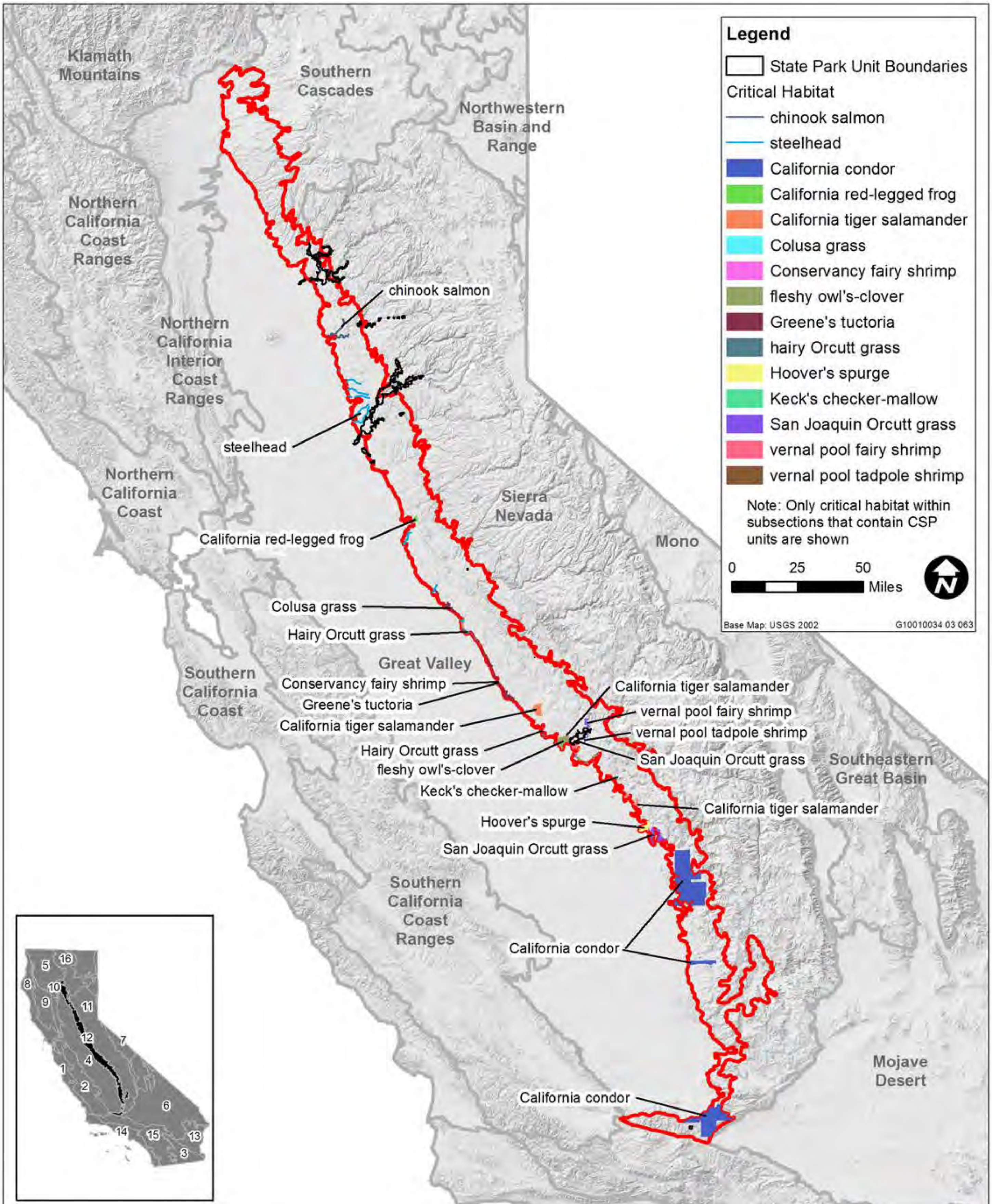
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-12b Sierra Nevada Foothills - USFWS Critical Habitat and California State Park Units

Table J-13a. USFWS Critical Habitat in Ecological Sections and Subsections

Sonoran Desert Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection
		FESA	Chocolate Mountains and Valleys
Wildlife			
desert tortoise	*Gopherus agassizii*	FT	X
razorback sucker	*Xyrauchen texanus*	FE	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

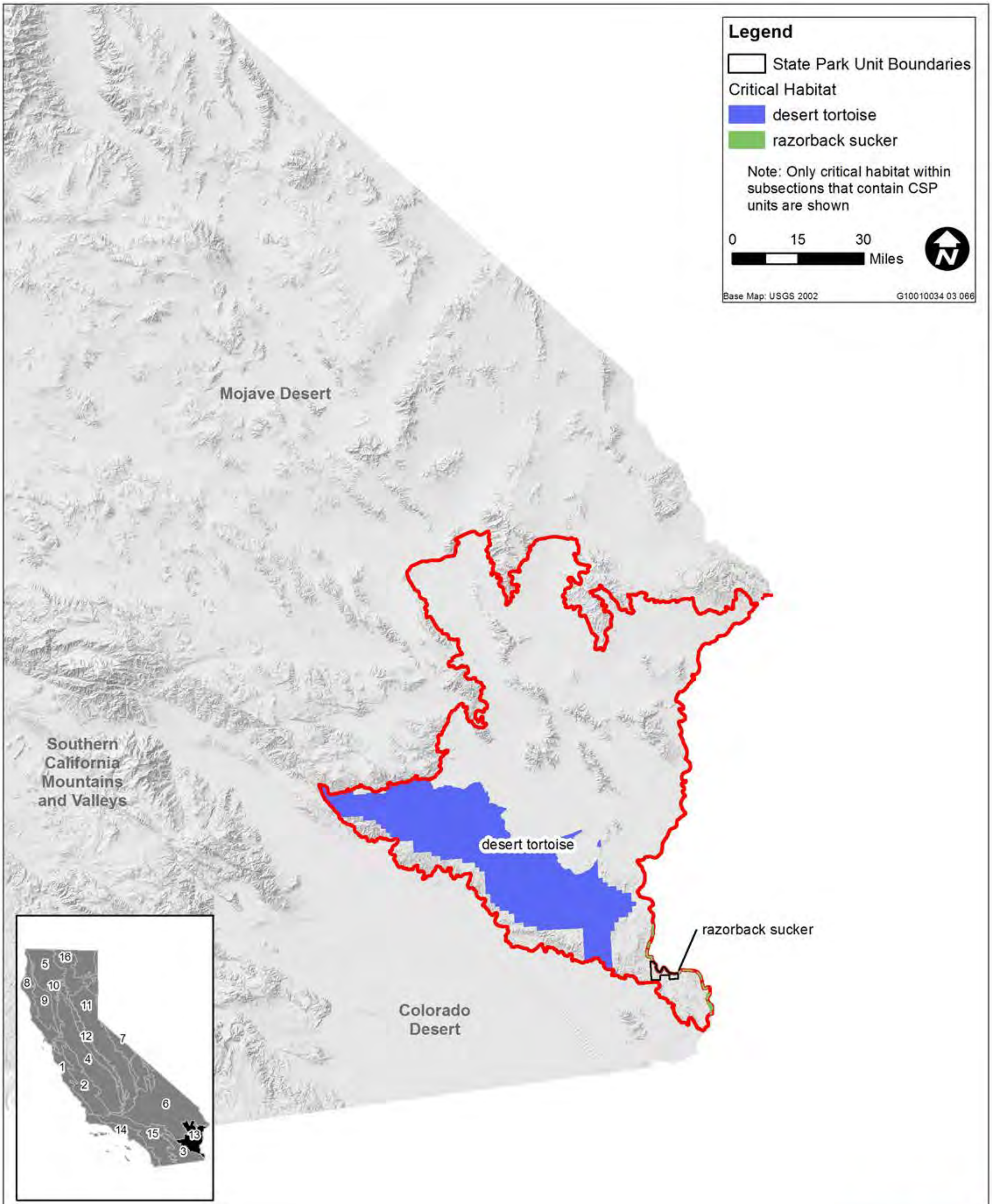
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-13b Sonoran Desert - USFWS Critical Habitat and California State Park Units

Table J-14a. USFWS Critical Habitat in Ecological Sections and Subsections

Southern California Coast Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection							
		FESA	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains
Plants										
Braunton's milk-vetch	*Astragalus brauntonii*	FE	X		X		X			X
Gaviota tarplant	*Deinandra increscens ssp. villosa*	FE							X	
La Graciosa thistle	*Cirsium loncholepis*	FE						X		
Lompoc yerba santa	*Eriodictyon capitatum*	FE						X	X	
Lyon's pentachaeta	*Pentachaeta lyonii*	FE					X			X
Mexican flannelbush	*Fremontodendron mexicanum*	FE	X							
Otay tarplant	*Deinandra (=Hemizonia) conjugens*	FT	X	X						
San Diego ambrosia	*Ambrosia pumila*	FE	X							
San Diego thornmint	*Acanthomintha ilicifolia*	FT	X	X						
spreading navarretia	*Navarretia fossalis*	FT	X	X						
thread-leaved brodiaea	*Brodiaea filifolia*	FT	X	X	X					
Ventura Marsh milk-vetch	*Astragalus pycnostachyus var. lanosissimus*	FE				X			X	
willowy monardella	*Monardella linoides ssp. viminea*	FE	X							

Table J-14a. USFWS Critical Habitat in Ecological Sections and Subsections

Southern California Coast Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection							
		FESA	Coastal Hills	Coastal Terraces	Los Angeles Plain	Oxnard Plain-Santa Paula Valley	Santa Monica Mountains	Santa Ynez Valleys and Hills	Santa Ynez-Sulphur Mountains	Simi Valley-Santa Susana Mountains
Wildlife										
arroyo (=arroyo southwestern) toad	*Bufo californicus (=microscaphus)*	FE	X	X				X	X	
California condor	*Gymnogyps californianus*	FE							X	
California red-legged frog	*Rana draytonii*	FT						X	X	X
California tiger salamander	*Ambystoma californiense*	FE						X		
Coastal California gnatcatcher	*Polioptila californica californica*	FT	X	X	X	X				X
least Bell's vireo	*Vireo bellii pusillus*	FE	X	X		X			X	X
Palos Verdes blue butterfly	*Glaucopsyche lygdamus palosverdesensis*	FE			X					
quino checkerspot butterfly	*Euphydryas editha quino (=E. e. wrighti)*	FE	X	X						
Riverside fairy shrimp	*Streptocephalus woottoni*	FE	X	X						X
San Diego fairy shrimp	*Branchinecta sandiegonensis*	FE	X	X	X					
Santa Ana sucker	*Catostomus santaanae*	FT	X		X					
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	X	X				X	X	
steelhead	*Oncorhynchus (=Salmo) mykiss*	FE	X	X		X	X	X	X	
tidewater goby	*Eucyclogobius newberryi*	FE				X	X		X	
vernal pool fairy shrimp	*Branchinecta lynchi*	FT						X	X	
western snowy plover	*Charadrius alexandrinus nivosus*	FT		X	X	X	X		X	

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

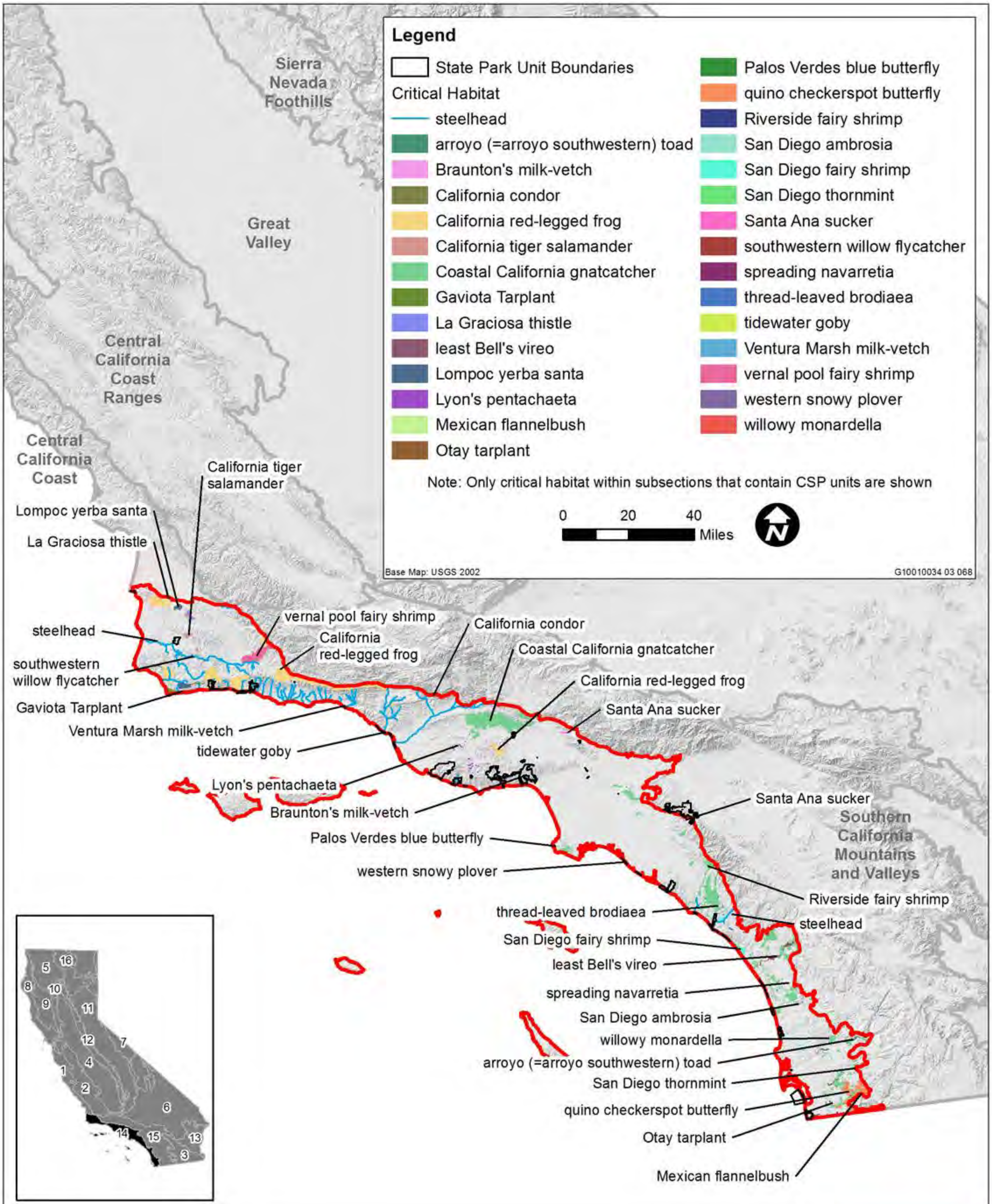
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-14b Southern California Coast - USFWS Critical Habitat and California State Park Units

ASCENT ENVIRONMENTAL

Table J-15a. USFWS Critical Habitat in Ecological Sections and Subsections

Southern California Mountains and Valleys Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection											
		FESA	Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Park	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills
Plants														
ash-grey paintbrush	*Castilleja cinerea*	FT							X				X	
Bear Valley sandwort	*Arenaria ursina*	FT							X				X	
California taraxacum	*Taraxacum californicum*	FE							X				X	
Cushenbury buckwheat	*Eriogonum ovalifolium var. vineum*	FE			X				X				X	
Cushenbury milk-vetch	*Astragalus albens*	FE			X				X					
Cushenbury oxytheca	*Oxytheca parishii var. goodmaniana*	FE			X				X					
Mexican flannelbush	*Fremontodendron mexicanum*	FE												X
Munz's onion	*Allium munzii*	FE						X				X		
Nevin's barberry	*Berberis nevinii*	FE						X		X				
Parish's daisy	*Erigeron parishii*	FT			X				X				X	
San Bernardino bluegrass	*Poa atropurpurea*	FE					X		X				X	
San Bernardino Mountains bladderpod	*Lesquerella kingii ssp. bernardina*	FE							X				X	
San Diego ambrosia	*Ambrosia pumila*	FE						X				X		X
San Diego thornmint	*Acanthomintha ilicifolia*	FT												X
southern mountain wild-buckwheat	*Eriogonum kennedyi var. austromontanum*	FT							X				X	
spreading navarretia	*Navarretia fossalis*	FT						X				X		X
thread-leaved brodiaea	*Brodiaea filifolia*	FT						X				X		
Vail Lake ceanothus	*Ceanothus ophiochilus*	FT						X		X				

Table J-15a. USFWS Critical Habitat in Ecological Sections and Subsections

Southern California Mountains and Valleys Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection											
		FESA	Desert Slopes	Fontana Plan-Calimesa Terraces	Little San Bernardino-Bighorn Mountains	Northern Transverse Ranges	Palomar-Cuyamaca Park	Perris Valley and Hills	San Gorgonio Mountains	San Jacinto Foothills-Cahuilla Mountains	San Jacinto Mountains	Santa Ana Mountains	Upper San Gorgonio Mountains	Western Granitic Foothills
Wildlife														
arroyo (=arroyo southwestern) toad	*Bufo californicus (=microscaphus)*	FE		X	X	X	X	X	X	X	X	X		X
California condor	*Gymnogyps californianus*	FE				X								
California red-legged frog	*Rana draytonii*	FT				X								
coastal California gnatcatcher	*Polioptila californica californica*	FT		X				X		X		X		X
Conservancy fairy shrimp	*Branchinecta conservatio*	FE				X								
desert tortoise	*Gopherus agassizii*	FT			X									
Laguna Mountains skipper	*Pyrgus ruralis lagunae*	FE					X							
least Bell's vireo	*Vireo bellii pusillus*	FE	X	X								X		X
mountain yellow-legged frog	*Rana muscosa*	FE							X		X		X	
peninsular bighorn sheep	*Ovis canadensis nelsoni*	FE	X				X							
quino checkerspot butterfly	*Euphydryas editha quino (=E. e. wrighti)*	FE	X				X	X		X	X			X
San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*	FE		X				X	X	X				
San Diego fairy shrimp	*Branchinecta sandiegonensis*	FE										X		X
Santa Ana sucker	*Catostomus santaanae*	FT		X								X		
southwestern willow flycatcher	*Empidonax traillii extimus*	FE	X	X	X		X		X	X		X	X	X
steelhead	*Oncorhynchus (=Salmo) mykiss*	FE										X		
vernal pool fairy shrimp	*Branchinecta lynchi*	FT				X								

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

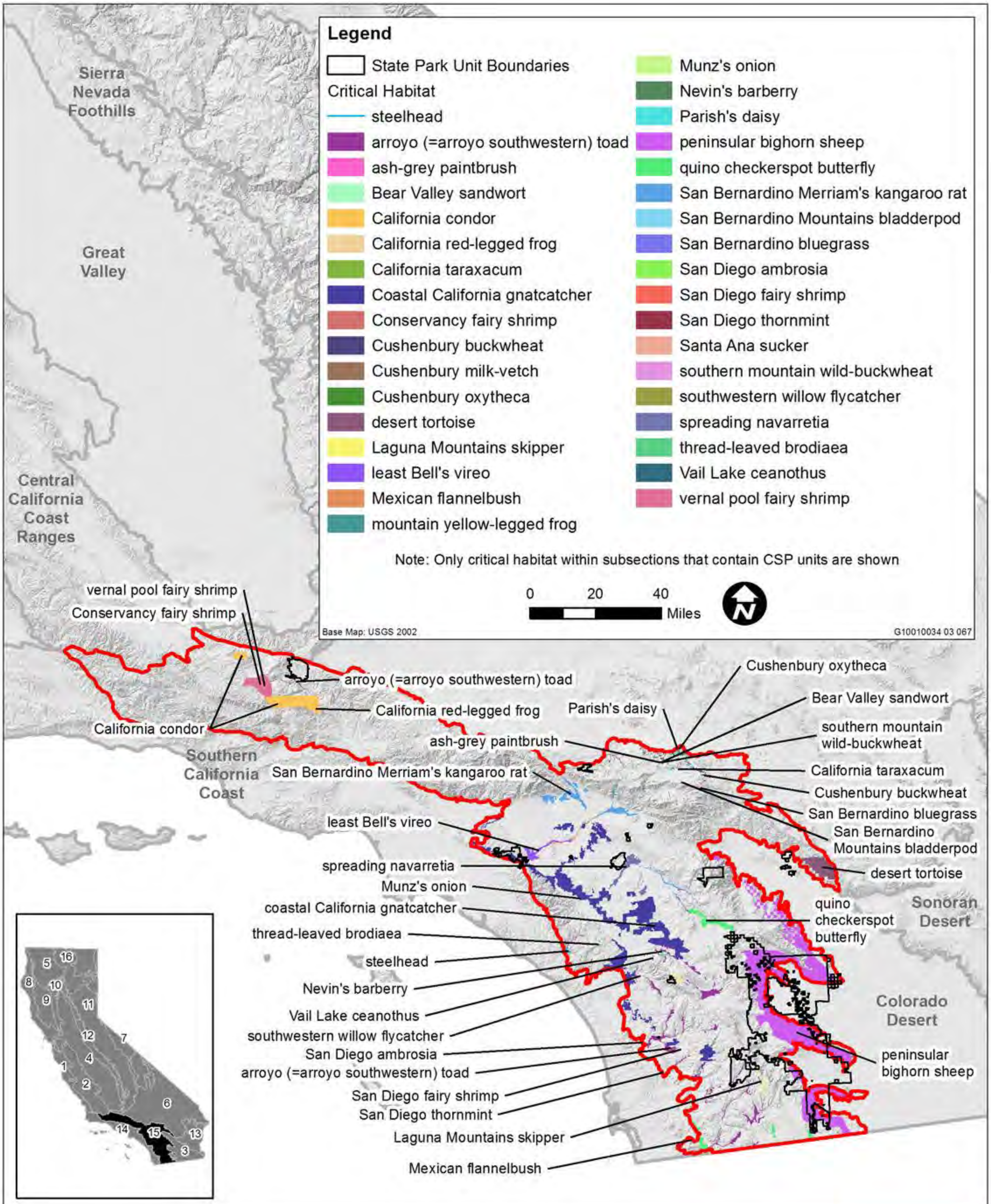
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-15b

Southern California Mountains and Valleys - USFWS Critical Habitat and California State Park Units

Table J-16a. USFWS Critical Habitat in Ecological Sections and Subsections

Southern Cascades Section

Common Name	Scientific Name	Status[1]	USFS Ecological Subsection	
		FESA	Hat Creek Rim	Medicine Lake Lava Flows
Plants				
Greene's tuctoria	*Tuctoria greenei*	FE	X	
slender Orcutt grass	*Orcuttia tenuis*	FT	X	X
Wildlife				
northern spotted owl	*Strix occidentalis caurina*	FT	X	X

Note: Only USFS Ecological Sections and Subsection containing State park units are listed

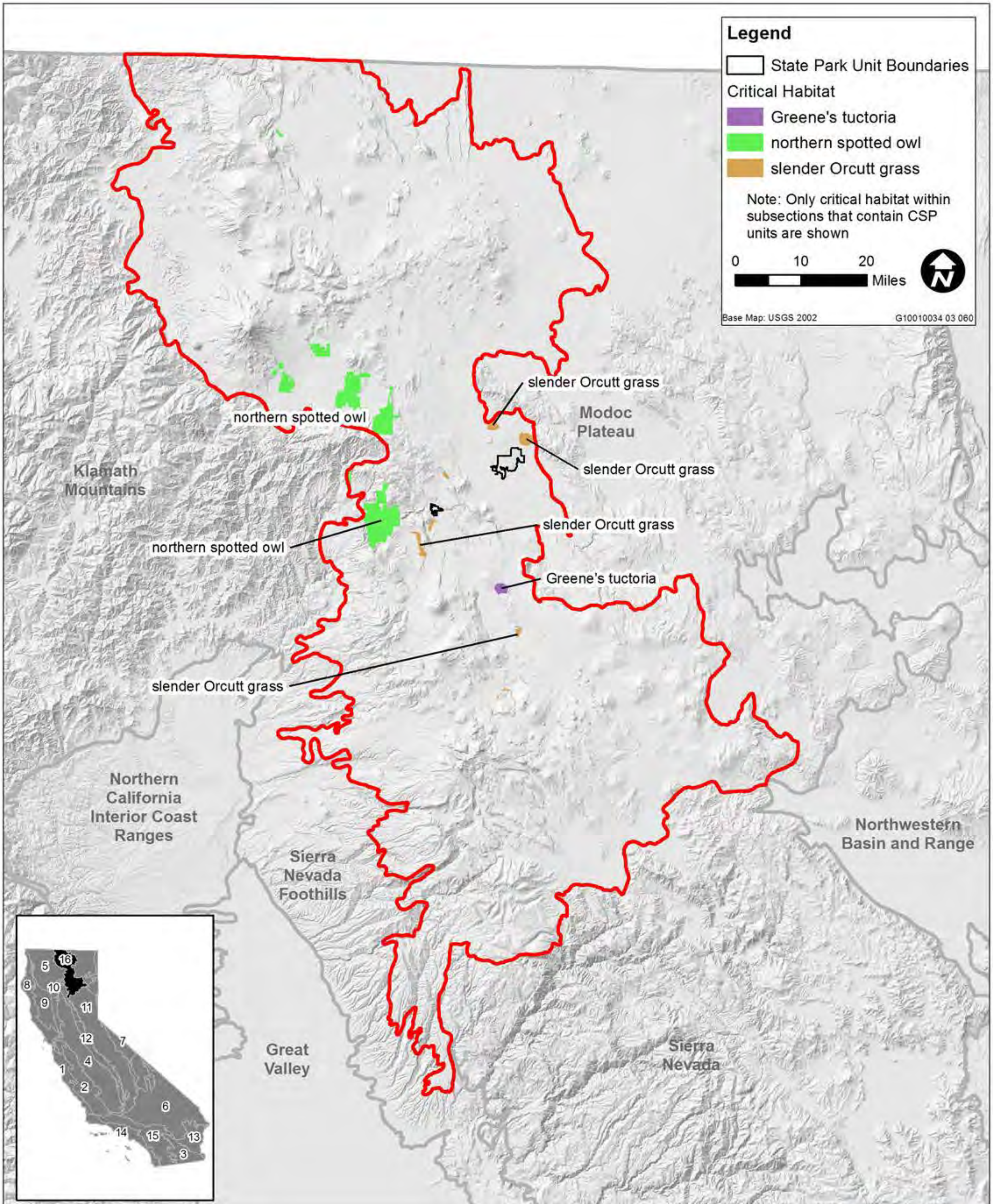
[1] Status definitions:

Federal Endangered Species Act (FESA):

FE Endangered

FT Threatened

Source: USFS 1997; USFWS 2011.



Source: Data received from CSP 2011, USFS 1997, USFWS 2011; Adapted by Ascent Environmental 2012

Map J-16b

Southern Cascades - USFWS Critical Habitat and California State Park Units

Appendix K

Road and Trail Change in Use Erosion Vulnerability Study

California State Parks
Road and Trail Change-in-Use Evaluation Process

Summary Report of Erosion Potential and Control Practices for Major Soil Types

PWA Report No. 11094901
August 2011

Prepared for:
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CONTENTS

1. INTRODUCTION

In March 2011, Pacific Watershed Associates, Inc. (PWA) was subcontracted by Ascent Environmental, Inc. to conduct a technical study pertaining to road and trail change-in-use impacts on soil erosion. The technical study was developed to address key issues related to erosion that are critical to the development of the California Department of Parks and Recreation (State Parks) Road and Trail Change-In-Use Evaluation Process Program Environmental Impact Report (PEIR). The main goal of the erosion study is to develop a framework for a practical analytical methodology that can be employed to evaluate existing and potential impacts on soil erosion in the PEIR and to assist State Parks staff making informed decisions regarding the change-in-use proposals for roads or trails. This methodology approach employs existing models, hybrid model(s), method(s), and other practical decision-making approaches that can be used by State Parks staff when reviewing change-in-use proposals.

This technical study involves: 1) a rigorous review of available relevant literature pertaining to the evaluation of soil erosion on trails, including the review of trail condition assessment techniques, and environmental and user defined processes that effect soil erosion; (2) evaluation of the suitability and appropriateness of erosion hazard models and decision framework tools that would help State Parks staff make informed decisions about whether proposed trail uses will have impacts on soil erosion; (3) development of a systematic and rational framework for a State Parks road and trail change-in-use decision-assistance tool based on site characteristics (topographic characteristics, soil types, trail features and trail use variables), sound science, and supported by sound technical literature; (4) evaluation of the State Parks trail evaluation procedures, including the Change-In-Use Survey Form, Trail Log, and California Geological Survey (CGS) Watershed Assessment Tool for consistency and transparency with the proposed decision-assistance tool and amending the State Parks procedures to include criteria data necessary for the decision-assistance tool; and 5) preparing a draft and final report of technical findings.

2. LITERATURE REVIEW

State Park’s mission is to “Provide for the health, inspiration, and education of the people of California by helping preserve the state’s extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation.” Trails in their many forms are a major component of the effort to meet the spirit of that mandate, providing access with which the public can enjoy the invaluable resources protected by the park system.

The California State Recreational Trails Plan states that: “Plans for optimal use of trail resources must be in concert with the objective of natural and cultural resource protection. Any decisions on resource use affect not only California residents and visitors, but our natural and cultural habitat as well. If we make responsible decisions concerning preservation of our resources, we will succeed in our custodial duties to the environment while at the same time providing enjoyment for current and future generations. Through well designed, constructed, and maintained trails, we will accomplish optimal public access while accommodating resource conservation" (State Parks, 2002, p. 6).

This policy provides the framework for the proposed State Parks Change-in-Use Evaluation Process that will be employed to evaluate and act on proposed changes in the uses on non-motorized trails within the State Park trail system. Trails are a primary recreational resource that provide safe access within park areas, support recreational opportunities such as hiking, biking, and wildlife observation, and protect natural resources by concentrating visitor traffic on resistant treads. However, increasing recreational use, coupled with substandard trail design and/or poorly maintained trails, has led to a variety of resource impacts. Many trails in State Parks were originally constructed as resource roads for logging, mining, farming or ranching. Others owe their origin to homesteading, early transportation routes (stage routes and overland supply trails), or locally developed paths and community trails that have since been incorporated into State Park lands. Others have been specifically designed and constructed to accommodate state park visitor uses. Regardless of their origin, trail managers require objective information on trails and their condition to monitor trends, direct trail maintenance efforts, and evaluate the need for visitor management and resource protection actions (Marion and Leung, 2001).

Much of the initial ecological change attributed to park trails was associated with their initial construction or development and is considered largely unavoidable (Birchard and Proudman, 2000). The principal challenge for trail providers in subsequent years is therefore to prevent post-construction degradation from both recreational use and natural processes such as rainfall and surface runoff. A perennial concern of trail providers is sustaining the condition of trail resources through a wide range of climatic conditions with highly concentrated foot, hoofed, and wheeled traffic. Most recreational trails in State Parks remain unsurfaced and are subject to degradation forces induced by environmental variables and recreational use. Indeed, trail degradation is a major concern for most trail providers. Although most park trails in State Parks are resilient and relatively resistance to excessive degradation, increasing pressure from an expanding park user population, the desire for a wider variety of approved trail uses, and increasingly diminishing maintenance budgets all work together to challenge the State Parks' dual mission to provide access and protect valuable park resources.

This literature review was developed from a search of the scientific literature on trail impacts and erosion. We primarily reviewed published scientific literature from peer reviewed journals, as well as objective literature prepared by scientists involved in parkland and wilderness trail management. We used our own expertise and professional judgment in evaluating the objectivity and conclusions presented in management reports and non-peer reviewed publications. We focused our efforts on identifying research reports and papers reporting results without obvious bias or value-judgments. Where statements may not have been adequately supported by the data, we used judgment in evaluating the methods and conclusions. We did not evaluate the adequacy or shortcomings of individual research studies, but did report what other researchers may have indicated as some of the limitations associated with earlier works.

Many of the projects and papers we reviewed were produced by government or academic researchers and their students. Some researchers, such as David Cole, Yu-Fai Leung and Jeffrey Marion, have been prolific publishers of their research on trail and trail impacts. They have been

widely quoted in the published scientific literature and have themselves produced literature reviews on a number of topics directly related to trail impacts and trail erosion. These reviews were especially helpful in distilling the most widely available and useful findings on trail erosion research and for identifying research that we had not previously seen.
An increasing amount of trail erosion research is occurring in other countries, and not all of that work is readily available or was reviewed. Different user preferences and trail management practices occasionally make the findings of these widely scattered studies more difficult to integrate with study findings in other areas and in the United States. There is also a wealth of less formal information on trail management that has been mostly produced by land management agencies. These reports and manuals contain information that has significant practical value to the subject of trail erosion and its control, but were beyond the scope of this analysis. Finally, with a few exceptions, we did not include an analysis of trail impact descriptions and trail management strategies published by user groups, although they often contain useful information on practices, and how to use and manage trails to reduce trail impacts from various user activities.

2.1 TRAIL STUDIES, DECISION FRAMEWORKS, AND OTHER RESEARCH

2.11 Recreation Ecology in Trail Studies

Recreation ecology can be defined as the field of study that examines, assesses and monitors visitor impacts, typically to protected natural areas, and their relationships to influential factors (Hammitt and Cole, 1998; Liddle, 1997; Marion, 1998). The term “impact” is used in this study to denote any undesirable visitor-related biophysical change of a park resource (i.e., a park trail or trail system and its affected environment). Trail and trail impact studies help managers identify and evaluate resource impacts, facilitating understanding of causes and effects and improving insights regarding the prevention, mitigation and management of problems (Leung and Marion, 2000). Today, park managers must seek scientific knowledge that is needed to make informed and defensible access and resource decisions. Without adequate and accurate resource knowledge managers may make decisions in the absence of sufficient scientific information, taking actions that are increasingly being challenged.

There is a cost to making incorrect or unsupported management decisions. Impacts that seriously disrupt ecosystem function or threaten legally protected natural or cultural resources are most significant. Long-term or irreversible changes are viewed as most problematic. Recreational impacts resulting from management decisions also have a direct monetary cost in increased maintenance. While some of these costs are inherent in managing natural areas and wildland trail systems, most financial resources are directed at avoiding, minimizing or repairing recreation impacts. A scientifically sound understanding of the consequences of proposed trail management actions, before they are undertaken, can save valuable time and financial resources and ultimately prevent unnecessary resource degradation.

2.12 Decision Frameworks

Part of sound decision making in the context of dual management directives of public access and resource protection involves acquiring sound scientific and resource information, and then applying that information in a logical and defensible manner. This challenge is one that is both necessary and difficult and is increasingly being faced by managers of public lands, parks and trails. Leung and Marion (2000) described the issue as follows:

"Faced with a limited resource base, limited budgets and increasing recreational demands, [park] managers must decide how much and what kinds of recreation use are acceptable, recognizing that any visitation generates some degree of resource impairment. They must explicitly define when visitation-related environmental change becomes an unacceptable impact, requiring management intervention. Research and monitoring can inform such decisions, but managers must make them, preferably in consultation with the public. Achieving an appropriate balance between the dual management objectives of resource protection and recreation provision frequently requires decisions that trade off recreation experience quality with natural resource quality. Such decisions are difficult and often controversial and must be defensible in both the court of public opinion and law" (Leung and Marion, 2000).

To help accomplish this, a science-based decision assistance framework can be employed. A decision framework is simply a standardized, repeatable process that employs specific data and input information and that provides structure to decision making for planning or management purposes (Hendee and van Koch, 1990). Historically, managers have relied on informal decision making when addressing visitor impact issues. An informal decision-making process is usually insufficient and is less likely to result in defensible decisions and outcomes that are both consistent with California Environmental Quality Act (CEQA) requirements and acceptable to the interested public. Common problems with this approach include a failure to explicitly describe intended resource or social conditions, evaluate the acceptability of existing conditions, conduct a thorough problem analysis or consider a comprehensive array of management alternatives (McCool and Cole, 1997).

Effective management decision frameworks should employ specific indicators and logical standards, and utilize objective resource inventory and monitoring protocols. Appropriate indicators are selected from the best available information as representing resource conditions that are limiting or could be impacted by the proposed resource management or visitor use action. While indicators are fairly fixed and have a limited set of appropriate condition or response classes, the standards against which they are evaluated should be based on the best available scientific information, professional expertise and analysis, and management evaluation. To the extent possible, assessment procedures and indicator variables should be as objective and accurate as possible: measurement procedures should be standardized, and measurement error should be minimized. It is recognized there will always be a certain amount of subjectivity in assessment procedures for some indicators. However, as with any data collection process, it is also important that the measurements and responses be accurate and repeatable. As new research information is learned, monitoring and inventory data should be changed or adapted to reflect the current state of knowledge. Regardless, there is a need for efficient and flexible monitoring protocols that can be employed within the context of available financial and personnel resources; otherwise managing agencies will not adopt or sustain them over time (Leung and Marion, 2000).

Formal decision-making frameworks offer a defensible process for defining desired future resource conditions for visitor impact management, identifying impact indicators and conducting problem assessments, and evaluating and selecting preferred management actions. They may be simple or complex, as long as they are transparent, repeatable, scientifically defensible and describe the steps by which decisions are made. Importantly, they should not be developed and implemented in a vacuum, as the process represents a commitment of financial resources, personnel requirements and available time. Such frameworks transform management mandates into prescriptive objectives that can be implemented and evaluated with standards defining the limits of acceptable conditions for selected resource and social indicators. Monitoring allows for recognition of unanticipated negative conditions and adaptive management actions that may be employed to correct these conditions.

2.13 Research Approaches

Trail impact studies have taken a number of forms, and the variety of research methods and subsequent analyses is one of the fundamental reasons study results can be difficult to compare. These include carrying capacity studies where resource impacts are evaluated against the amount of use, or more direct investigations into the relationship between environmental attributes, user variables and the nature and magnitude of impacts. Research has employed experimental or plot studies where inputs (use type and intensity) are controlled, as well as by studies where data from established trails are correlating with various site and use variables to infer cause-and-effect relationships. Early research on trail impacts focused on impact severity and environmental factors affecting trail degradation (Leung and Marion, 1996). More recently, the focus has been on the selection of indicators, standards and monitoring protocols to support management planning frameworks such as the Limits of Acceptable Change (LAC) or other visitor impact management or visitor experience and resource protection frameworks (Leung and Marion, 2000).

Cole (1987) discussed four major study designs use to assess wilderness and trail impacts:

1) Descriptive surveys (resource condition assessments).
2) Comparisons of used and unused sites (or impacted and unimpacted sites).
3) Before-and-after natural experiments.
4) Before-and-after simulated experiments.

The ability of various trail impact study and assessment designs to isolate cause-and-effect varies. Increasingly, trail and trail impact research has been occurring across the globe for several decades. Although a number of general relationships and common themes have been identified, variable study designs, site conditions, and user activities have limited their use for cross correlation, extrapolation, and confirmation of the more subtle causal relationships. In addition, studies of relatively new forms of recreation, such as mountain bike riding, have simply not yet been fully explored. With a few exceptions, most impact studies have been conducted in the last few decades (beginning in the 1970s and 1980s) and evaluation of the influence of user data is even more recent. Regardless, over the last 20 years there has been substantial progress in knowledge and understanding of recreation trail impacts and in the practices of impact avoidance and management. Most of these studies are the result of experiments or static point-in-time cause-and-effect analyses. There are very few long-term monitoring data sets describing temporal changes in trail conditions, largely because parkland and wilderness management agencies are unable to invest the resources that are required to initiate and maintain such research data sets. The few data sets that have been reported come either from federal research personnel or university researchers.

2.14 Trail "Degradation" Research

Trail degradation has often been referenced as trail impact, trail erosion, trail wear, and trail deterioration (Leung and Marion, 1996). Trails in natural areas are considered a necessary means of concentrating visitor use in a discrete and limited area where resource impacts to the natural area or park can be limited or controlled. As such, trails serve a valuable resource protection function, and they are expected to show some deterioration with use and over time. Trail degradation research focuses on how trails as a resource can be protected from degrading, through a variety of design approaches and management actions.

As they have been described in the scientific literature, trail degradation studies are specifically focused on the effects of trail use on the tread surface after they are constructed or created. Without use, most trail treads would show little deterioration over time, consistent with and perhaps slightly greater than surrounding terrain. Trail degradation related to visitor use typically includes the process of erosion and other trail impacts, such as widening and muddiness, which may not involve significant soil loss. From a management standpoint, trail degradation studies address the four most critical deterioration problems associated with trails: soil compaction, trail widening, muddiness, and trail incision (erosion and soil loss). Soil loss is particularly important, because it is not self-limiting, unlike many other forms of trail impact (e.g., compaction) (Leung and Marion, 1996).

Trail erosion, the most restrictive degradation term, refers specifically to assessments of processes, causes, and consequences of soil erosion on the trail tread. Once a trail is established, the soil comprising its tread is subject to the continuing erosional forces of rainfall, surface runoff, wind, freeze/thaw cycles, gravity, and visitor traffic. Spatial variability in the environmental characteristics of a trail system, an individual trail, or a trail segment will result in varying levels of erosional susceptibility to the driving forces of soil detachment and movement. Trail erosion is controlled by the interaction of these environmental variables, the actions of the trail users on the trail tread, and the forces that act on the tread to cause soil erosion. Just as identifying specific environmental attributes and the roles they play in controlling trail degradation is vital, so is the identification of the disturbance attributes imparted by various users and user actions. Identification of the critical environmental attributes of a potential trail alignment permits the avoidance of sensitive locations and/or the establishment of preventive measures to control or minimize trail impacts, including erosion. Similarly, identification of critical use-related effects on trails in specific environmental settings can be employed to manage use such that impacts can be avoided through mitigation, avoidance or other management actions.

Research on trail erosion is not new, but is becoming progressively more systematic and thoughtful in its focus. Leung and Marion (2000) identified seven basic research themes and questions in current wilderness impact research, including those related to trail erosion. These are fundamental research questions that most managers could readily use for decision making, but on which they rarely have sound scientific information:

1) What types of recreation trail impacts exist? (direct effects [e.g., erosion] vs. indirect effects [e.g., habitat degradation; visitor use impacts; etc]);
2) What is the magnitude and significance of these impacts? (intensity of impacts and spatial quality of impacts);

3) What is the relationship between amount of use and intensity of impact? (carrying capacity, threshold levels of impacts, complex relationships, determining indicators and standards that reflect explicit levels of acceptable impacts);
4) What factors contribute to the problem? (interaction of use-related and environmental factors);
5) Have conditions worsened or improved over time? (need for monitoring and long-term data sets with relevant variables);
6) How effective are visitor and site management actions? (implementing various visitor and site management actions to reduce or contain impacts, and monitoring results);
7) How can research and impact assessment methods be improved? (refining the appropriate stressor, indicator and response variables; refining measurement accuracy and precision requirements) (Leung and Marion, 2000).

2.2 TRAIL EROSION

Soil erosion is considered the single most important, managerially significant, trail degradation indicator (Marion et al., 2006). As an indicator, it is commonly expressed as trail incision, trail surface lowering, or erosional cross-sectional area. Soil erosion is the only trail degradation indicator, relatively speaking, that does *not* recover naturally over time. Soil loss from trails could be considered a significant “irreversible” form of impact because most of the soil is transported off trail treads where it cannot be naturally retrieved and replaced. Trail erosion has the potential to adversely affect all aspects of the park environment, including ecological processes, visitor experiences, and managerial actions. Erosion can impact adjacent and downstream aquatic resources and sensitive habitat as sediment is transported from the trail to the native stream network. Trail erosion and related impacts can affect on-site resources and environments through muddiness, trail widening, tread downcutting or incision, trail braiding and the resultant impacts to protected cultural and biological resources, including downslope aquatic habitats. Excessive erosion can encourage users to seek off-trail routes, which can lead to damage of unprotected areas (Hammitt and Cole, 1998; Marion et al., 1993).

The impacts of soil erosion include undesirable trail conditions, which can adversely affect recreational experience and visitor safety. Trails that are deeply eroded or muddy, or contain multiple or undesired trail segments and scars, are aesthetically and socially undesirable as well as being unsustainable and potentially hazardous to visitors. Eroded trails may have significant amounts of exposed roots, which can decrease the functional utility and safety of the trail. Finally, trail erosion caused by recreational use threatens the dual resource protection mandates of park managers to provide access while protecting park natural resources.
Although the total amount of erosion from non-motorized recreational trails would typically be considered negligible at landscape or even watershed scales, trail erosion and subsequent sedimentation and degradation of trail-adjacent habitats can be a locally significant ecological and managerial problem. It is important to be able to isolate and determine the importance of environmental and user-related variables that contribute to and control trail erosion. With appropriate and accurate user and environmental data, managers can determine how and where to focus managerial controls and mitigation efforts to provide the required protection to park resources (Godwin, 2000).

2.21 Factors affecting trail erosion

The type and extent of trail erosion impacts are influenced by use-related and environmental factors, both of which may be modified through management actions. Environmental factors include attributes such as vegetation and soil type, topography and climate. Use-related factors include type of use, amount of use, and user behavior. Comprehensive reviews of the role of these factors are provided by Leung and Marion (1996), Hammitt and Cole (1998), Kuss et al. (1990), Liddle (1997) and Marion (1998). Finally, managerial actions can be used to exert substantial influence on most environmental and use-related variables by modifying their roles and thereby diminishing their importance and effect on the magnitude of trail erosion impacts.

2.211 Environmental factors

Many trail impact problems are the result of inadequate design, poor construction, or poor location, rather than higher impacting types or amounts of use (Cole, 1987; Leung and Marion, 1996, 2000). In fact, most researchers have concluded that environmental variables play a fundamentally more important role on the nature and magnitude of trail erosion on existing non-motorized trails than do user-related factors. They point to the fact that many existing trails have sections ranging from good to poor condition, yet each trail likely receives the same types and amounts of use. Thus, problems like muddy soils or eroded treads are primarily a function of trail routing through wet soils or up steep slopes. The problems are more trail-dependent than user-dependent, although without visitor use the erosion and degradation problems would likely not become significant. Applying tread reconstruction and maintenance solutions to such problems can be expensive, effective for only a short time, and give the trail a more “developed” appearance that can alter the nature of recreational experiences (Aust et al, 2005). As a result, proper trail location is fundamentally important in the development of sustainable routes. Once routes are established, the only corrective options that remain are maintenance and engineering solutions, short trail reroutes or larger relocations that will provide an effective long-term solution for sustaining traffic, while minimizing resource impacts.

Climate and geology are the primary environmental factors that act in concert to create and influence topography, soils, and vegetation (Leung and Marion, 1996). Climate, through weather and precipitation, is the principal driving force for trail erosion by producing snowmelt, rainfall and emergent groundwater that are translated into runoff on the trail surfaces. In the larger picture, climate and geology act to determine topography, but it is the topographic characteristics of a park’s landscape that most directly influence the layout of trails and their inherent susceptibility to erosion, together with other site characteristics (e.g., soil erodibility, soil moisture, etc). The characteristics of these intermediate environmental factors are important determinants or drivers of trail degradation and erosion, and their individual roles are generally described below.

Climate and geology

Climate and geology are two basic groups of environmental factors that affect trail degradation primarily through their influence on other factors. Their effects are typically indirect and are mediated by intermediate elements, such as vegetation and soil characteristics. Occasionally, usually in more arid settings where soils are especially thin, bedrock geology acts directly by comprising the tread surface or trail cutbank and imparting erosional resistance. Climate typically acts as an indirect influence on topography, soils development and vegetation patterns.

Precipitation, as a component of climate and weather, has a direct and important impact on trail erosion. Precipitation, via raindrop impact and surface runoff, directly erodes tread surfaces through sheet erosion, rilling and gullying. Likewise, precipitation that eventually becomes snowmelt, springs and seeps on and along the trail contribute to soil saturation and surface runoff.

Research findings relating the influence of climate and geology on roads and road-related erosion are common in the literature. This road-related literature, although not summarized here, is equally applicable to trails. Trails, in essence, are sometimes similar to small versions of roads (depending on design), with comparable topologic characteristics, drainage issues, stability concerns and erosional characteristics. One of the relationships between these factors is illustrated by the research finding that trails at high elevations exhibit greater soil loss than those at lower elevations (Burde and Renfro, 1986). This may be attributed to higher precipitation rates and extended periods of snowmelt in the mountains, which create muddy soils and a higher potential for user-caused erosion and trail degradation. Additionally, loose soil from more severe freeze/thaw cycles and higher erosion rates on steep trail slopes, and increased exposure to wind erosion, may also contribute to these findings (Leung and Marion, 1996).

Trail-side vegetation

The effects of off-trail trampling on vegetation are well documented (Cole, 1987; Kuss et al., 1990). But for established trails vegetation plays more of a role in containing or preventing trail widening, stabilizing cutbanks, and resisting gullying where concentrated runoff is discharged from a trail surface. In general, understory vegetation with high density, resistance to trampling, and resilience (i.e., recovery potential) will serve to inhibit trail widening. In open meadows or other grassland settings the lack of dense, woody trailside vegetation allows for the development of multiple treads wherever and whenever degraded trail conditions result in users deviating from the established tread. Less resistant vegetation, erodible soils and/or steeply sloping surfaces act to increase the potential for degradation when traffic leaves the established tread. At low use levels, vegetation types with high trampling resistance and resilience can sustain occasional use with little degradation but this protection rapidly diminishes with increasing use and is relatively unimportant at high use levels (Cole, 1988).

Topography and landforms

Elements of landscape and site topography have been perhaps the most intensively investigated environmental influences on trail degradation (Aust, et al., 2005, Godwin, 2000; Cole et al., 1987; Leung and Marion, 1996). Topography includes the character of the landscape through which a trail runs (e.g., sideslope steepness), as well as the relationship between the trail and the landforms it traverses (e.g., trail grade). For example, numerous studies have documented strong positive relationship between trail slopes and soil loss on erodible trail segments (Weaver and Dale, 1978; Bratton et al., 1979, Teschner et al., 1979). The greater velocity and erosivity of surface runoff that are obtained on steep trail slopes are the predominant causes, but other influences, such as the action of feet, hooves, and wheels, are also likely contributors. The combination of steeper slopes and the shearing action caused by trail users loosens surface soil particles and compacts lower levels of soil, hence enabling subsequent soil erosion (Coleman, 1981, Quinn et al., 1980).

From the terrain perspective, landform sideslope through which a trail runs can also be an important physical factor related to trail degradation (Bratton et al., 1979). The increased excavation required to place a trail on steep side-slopes with shallow soils can make them more vulnerable to cutbank slumps, erosion, and dry ravel from the inside of the trail, as well as fillslope landslides and mudslides (Garland, 1983). Helgath's (1975) study indicates that landslides occur more often where sideslopes over 78 percent. The slope of the landform on which the trail is located can also have an interaction effect with user behavior. As slope increases, the lateral spread of hikers decreases (Coleman, 1981). Trails built on steep slopes are more likely to form and maintain a single tread character.

Different trail positions relative to the landform can lead to several site-specific problems. Trails built on steep basal slopes and lower hillslope positions are also more likely to exhibit seeps and springs that can degrade the trail surface, cause erosion and require drainage control. Trails are commonly positioned in valley bottoms and along streams but drainage can be particularly difficult, especially if the trail encounters wet soils and becomes entrenched. Persistently wet soils cause users to walk around problems and create multiple trail treads and excessive trail widths. These wider trail sections expose fine-grained, valley-bottom soils to excessive erosion and can create water quality problems in adjacent streams and at stream crossings (Nepal, 2003; Leung and Marion, 1999; Bryan, 1977). Cole (1983) and Marion (1994) suggest that unless a trail is re-routed completely out of vulnerably valley-bottom locations, construction of major drainage structures and strengthened walking surfaces may become necessary to address soil erosion and trail degradation that cannot otherwise the treated with traditional drainage features.

Proximity to springs, seeps, or streams higher on the hillslope increase the susceptibility of trails to erosion, excessive wetness, and periodic flooding. These are indicator variables to be considered in evaluating the trails susceptibility to future erosion. Unless adequate and effective drainage and hardening features are employed, trails with compacted, eroded, puddled, and muddy tread surfaces will be unavoidable. Increased trail use can make the condition worse. Degradation and trail erosion can be minimized in these midslope trail positions with low trail slopes, high slope alignment angles, moderate-to-steep sideslopes and stream crossings that separate flow from the tread surface (Leung and Marion, 1996).

In montane areas, horse trails positioned immediately below the crest of hilltops have been found to be highly susceptible to erosion, while those located in valley bottoms were least susceptible to erosion and most susceptible to increases in width (Summer, 1986). Trail use in these upper elevation areas exposed soils to erosion caused by geomorphic processes and climatic factors. Like trails and roads that climb the fall line of a hillslope, perpendicular to the topographic contours, ridgetop trail positions (those running along the crest of a ridge) are highly susceptible to degradation and erosion because of the difficulty of draining water from the tread (Leung and Marion, 1996). Low slope alignment angles, where the road or trail climbs directly up a hillslope, even if the slope is gentle and regardless of its topographic position (valley bottom, midslope, ridge crest) makes a trail highly vulnerable to erosion, regardless of any other favorable environmental or use-related variables. The importance of slope alignment angle, and the potential for increasing erosion rates, increases as trail slope increases. Side-hill designs, located anywhere between the top and the bottom of a hillslope, are strongly recommended as being the least prone to erosion due to the ease with which water can be drained off the outside of the tread (Birchard and Proudman, 1981; Bratton et al., 1979).

Soil and surface characteristics

Soils play an important role in trail degradation and trail erosion research. Like an unsurfaced road, trail treads are essentially composed of compacted, bare soil. In some environments, organic litter may provide some protection from direct rainfall, but in most settings the exposed trail tread is subject to rainfall, surface runoff and resultant soil erosion. Intentional compaction of a trail tread, through construction and then visitor use, is an intended process that effectively hardens most trail surfaces. Compaction prevents the infiltration of water into the soil, forcing it to remain on the trail tread (Pritchett, 1979). Although composed of bare soil, compacted trail surfaces are more resistant to erosion than loose, uncompacted, bare soils.

Trail surface compaction that occurs during the construction process is generally uniform across the trail tread. Over longer time periods of subsequent visitor use compaction is preferentially located along the trail tread and may lower the surface of the tread relative to the surrounding areas. This creates an elongated depression along the length of the tread, in response to centralized user traffic, and acts to divert and concentrate surface runoff that originates from rainfall, snowmelt or springs emerging from the cutbank (Ferguson, 2005). If the tread is sloped and has a grade, the water is channeled down the trail tread, and may scour and transport eroded sediment. Waterbars dips and rolling grades are used to provide regular drainage along well used trails. If there is no grade to the trail tread, water may collect and pool at the surface (Wallin and Harden, 1996; Harden, 1992; Hammitt and Cole 1998; Manning, 1979; Lutz 1945). Ultimately, compacted, well-drained treads provide a more stable and resistant surface that sheds water to resist muddiness, minimizes the potential for soil erosion and keeps traffic from wandering off-trail where resource damage could occur.

Soil properties, including *soil wetness, texture, structure, and depth*, influence the ability of soil to withstand a given type and amount of traffic (Demrow and Salisbury, 1998; Scottish Natural Heritage, 2000). *Poorly drained soils* turn muddy under visitor traffic and this indirectly encourages users to leave the tread and widen the trail (Bryan, 1977). Saturated and wet soils, especially those that are low in organic content, become increasingly susceptible to erosion and transport as trail grades increase. These problems are increased if trails are located near streams and groundwater discharge areas (Leung and Marion, 1996). Wet soils and related impacts may be pronounced in high elevation areas where snowfall is followed by an extended period of snowmelt, or in climatic zones where the rainy season is long, annual precipitation is especially high, or in high precipitation coastal zones where dense overstory vegetation prevents rapid soil drying. Trail impacts, including erosion and muddiness in these areas may be managed using seasonal limitations during times of the year when rainfall or snowmelt is particularly high, or by the use of more costly trail engineering and maintenance practices that can sustain traffic and avoid muddiness in wet zones (Hesselbarth and Vachowski, 2000).

Researchers have investigated a number of physical soil properties to evaluate their influence on trail degradation and erosion (e.g., Sutherland et al., 2001). The soils that form the foundation for an unsurfaced trail tread can vary from highly erodible to highly resistant, and this environmental variable plays a significant role in determining the overall stability of the trail tread to visitor use and its resistance to soil erosion by running water. Trails traversing soils with fine, homogeneous *soil textures* are more erodible and often have greater tread incision (Bryan, 1977; Welch and Churchill, 1986). Soils high in silt and clay, especially expansive clays, can become impassibly muddy when wet, and hard, cracked, and dusty when dry. Loam and sandy-loam soils, because of their even mixture of silt, clay and sand, and their natural ability to compact, provide the fewest limitations for trails (Demrow and Salisbury, 1998; Hammitt and Cole, 1998).

Soil structure imparted by rock and gravel in the mineral soil further strengthens soils to support heavy traffic while concurrently resisting erosion and muddiness (Marion and Olive, 2006). Soils with high rock content are usually more resistant to user disturbance (churning) and soil erosion (Bryan, 1977; Weaver and Dale, 1978). Rock fragments in the soil resist detachment and erosion and provide structure that helps bind and protect the finer particles (Aust et al., 2005). In the presence of concentrated runoff, rocky soils often self armor as the finer soil particles are winnowed away and the surface is left with a lag of comparatively non-erodible rock fragments. Rock is often added to weaker erodible trail surfaces, and to trails that experience high levels of horse traffic, to artificially impart increased soil strength and resistance to erosion (Marion and Leung, 2004). Rocks and gravels are less easily eroded by water or wind, and these materials can act as filters, retaining and binding finer soil particles (Summer, 1980, 1986).

Soil depths to bedrock of greater than one meter have been found to be more stable and less prone to saturation and muddiness (Aust et al., 2005). Extremely thin soils, such as those in alpine and high elevation terrain, or in arid and semiarid environments, are more easily eroded and lost, forming depressed trail treads that may eventually be footed on relatively resistant bedrock (Demrow and Salisbury, 1998).

Finally, trail roughness refers to the smoothness of the trail tread. Roughness is often the combined result of soil structure, soil depth, and trail erosion processes. In deeper soils and forested environments trail roughness may be the result of long term trail surface erosion where fine soil particles have been eroded away leaving only the coarser, more resistant materials, including exposed stones, rocks and tree roots. In shallower and rocky soils, trail roughness may be the result of exposed bedrock or simply reflect the stoniness of the soil. Rough trail surfaces may provide protection again soil erosion but may also impede certain types of user traffic. They may cause trail widening as users seek smoother terrain.

2.212 Management factors

Few studies have directly examined the influence of managerial actions, though they have considerable potential for modifying the roles of both use-related and environmental factors (Leung and Marion, 1996). For new trail construction or trail realignments, managerial actions include such elements as the location, standard, alignment, and grade of the trail, all of which have a profound effect on trail stability, erosion rates, and performance over time (Leung and Marion, 1996). On existing trails, managerial actions can be employed to ameliorate potentially adverse environmental and user variables to make the trail more resistant to erosion. Through trail rerouting, reconstruction, and maintenance actions managers can harden treads, improve drainage, or even alter problematic alignments in sensitive trail locations so as to make weak segments more sustainable and less subject to erosion (Proudman and Rajala, 1981). Managers can also exert significant control over use-related erosion factors that would otherwise lead to unacceptable erosion. These actions might include reducing the amount and type of use or modifying visitor behavior that is contributing to excessive trail degradation and erosion (Doucette and Kimball, 1990). This can be accomplished through education, signage, rule changes, seasonal restrictions or closures, and/or enforcement.

Trail location

Trail location has a fundamental influence on the susceptibility of an alignment to degradation and erosion. Trails which pass through erodible soils, areas of emergent groundwater, or steep, unstable terrain are likely to be prone to erosion problems. The same considerations apply to locating and designing trail reroutes so that they provide sustainable trail surfaces. Muddiness can be limited by avoiding wet organic soils and flatter terrain, erosion can be limited by avoiding steep trail grades and low trail alignment angles, and parallel treads and tread widening can be limited by locating trails in sloping terrain where steeper side-slopes provide ample opportunity for trail drainage and keeps visitors on the designated tread (Birchard and Proudman, 2000).

New trail routes are ideally developed with a knowledge and understanding of the relationships between environmental factors, user requirements and trail impacts, such that the most resistant and sustainable routes can be selected. However, well established trails in many natural areas are often decades old and were developed and designed for pedestrian (hiking) use with little consideration for other uses that have become popular over time. Some trails in natural areas follow the routes of converted historic roads or roads that were developed for past land management activities before the areas received protection. As a result, older trails do not always benefit from thoughtful location analysis and design, and may contain segments that are prone to erosion or other problems that stem from their initial alignment. Oftentimes, managers have to choose between heavy maintenance, engineering, or trail rerouting to solve erosion and degradation problems in these areas; all of which are expensive options. Newly expanded uses on these trails may exacerbate these inherent erosion problems.

Trail standards

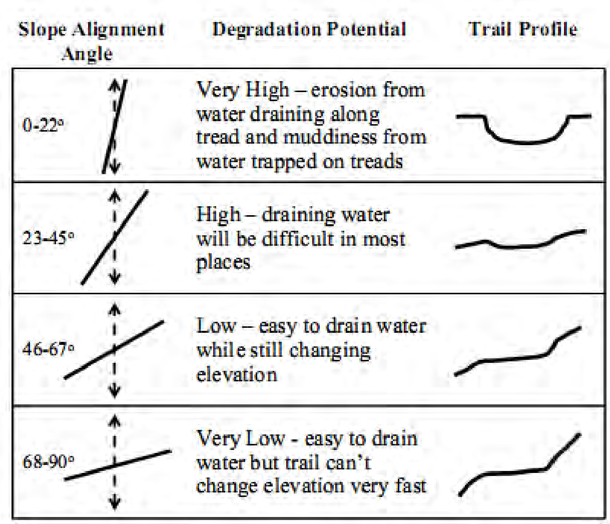
Construction and maintenance standards are perhaps the most important managerial elements used to control trail impacts, including erosion. Trail standards have an effect on the resilience of a trail to impacts. In general, a high standard trail will likely be more resistant to erosion and degradation. Similarly, compared to a low standard trail, a trail that is maintained to a high standard is less likely to display significant erosional impacts regardless of the environmental conditions and use levels it experiences. Unfortunately, these types of management actions, because they are often expensive, are sometimes neglected and may be traded for use-related restrictions and regulations aimed at lowering impact levels.

Through educational, regulatory, and enforcement actions, managers can also theoretically influence or control virtually all use-related factors that would otherwise result in trail impacts (Aust et al., 2005). For example, the impacts that one user type may have on a trail can be limited by restricting their use to resistant trails, prohibiting their use on steep, non-graveled trails during wet seasons, or limiting their numbers. Trail construction and maintenance actions are management-related activities that are used to reroute unstable trails, harden trail surfaces, improve drainage, and construct measures to limit or control erosion and other forms of physical trail degradation. These not only directly control erosional impacts, they also affect user behavior in the vicinity of the degraded trail section, eliminating the cause of tread widening and secondary tread development (Birchard and Proudman, 2000). User-related managerial actions and restrictions may be insufficient to protect resources or reduce trail erosion. Even where they are effective to correct or reduce some trail erosion problems, they may also be more likely to be criticized by the public without parallel educational efforts.

Grade or slope – Of all the common trail standards, grade has been shown to be positively correlated with tread erosion in many environments (Dixon et al., 2004; Nepal, 2003; Farrell and Marion, 2001, 2002; Gager and Conacher, 2001). In general, as grade increases the magnitude and potential for erosion increases (Helgath, 1975). It is important to note that although research indicates that trails with steeper grades are more prone to erosion, and erosion is likely to increase with increasing grade, not all steep trails actually erode or display erosion problems. That is, trail grade alone may not adequately predict trail erosion rates. Again, trail drainage is fundamentally more important to the occurrence of erosion than is grade alone and even moderately sloped trails with excessive runoff can experience rapid erosion (Sutherland et al, 2001, Gager and Conacher, 2001). Thus, slope must be combined with other contributing variables or factors (runoff rates, soil erodibility, vegetative cover, use type and intensity, etc) to trigger the occurrence of significant trail erosion.

Increasingly steep trail grades causes runoff to accelerate and increases the shear stresses of flowing water on the trail tread. At a point, thresholds are exceeded and soil particles are detached from the tread surface and transported downslope (Coleman, 1981). Erosion on road surfaces is a well studied and documented process that results in surface erosion, rilling, and gullying that eventually impacts not only the road surface but damages nearby streams and aquatic habitat with transported sediment. Trails act similarly. Erosion caused by concentrated surface runoff can occur on even moderately sloped trails of 7 to 15 percent grade if other favorable environment factors (e.g., soil texture or user-churned soil) are present (Sutherland et al., 2001). Research has also confirmed that the upslope length of the trail contributing runoff to an eroding trail segment directly affects the severity of soil loss (Gager and Conacher, 2001). This is the result of a simple drainage area - stream power relationship, and one that is solved by improving trail drainage. Thus, Gager and Conacher (2001), Leung and Marion (2000) and Cole (1991) reasoned that the up-gradient trail length (i.e., drainage area) to the nearest water break, as well as trail slope, control the volume and velocity of runoff on the trail tread and could thereby act as joint indicators of trail erosion potential.

Trail alignment and position - Trail or slope alignment angle refers to the topographic orientation of a trail in relation to the orientation of local landform slopes. Trail alignment can be expressed by the slope alignment angle: the orientation of the trail tread relative to the fall line of the landform it traverses. It is measured in degrees from 0 to 90, with 0 degrees representing a trail that is climbing directly up the slope, perpendicular to the topographic contours. Trails



can be aligned parallel to the prevailing slope direction (0° angle – straight up the hill), perpendicular to the slope (90° angle – perfectly on contour), or at any angle in between (1 - 89° angle).

Trail alignment angles are not always indicative of trail grades. That is, the trail could climb directly up a 5 degree hillslope or a 20 degree hillslope – completely different trail grades but the same slope alignment angle (0 degrees). Steep trail grades are more closely related to trail erosion when the alignment angle is low, because water flows straight down the trail and cannot be effectively drained from the trail tread (Bratton et al., 1979; Gager and Conacher, 2001). These are often called “fall-line” trails because they fall directly down the steepest line of the hillslope. Almost all fall-line trails eventually erode until they become gullied by runoff (Yoda and Watanabe, 2000; Bryan, 1977). Maintenance requirements will be high because runoff is unable to be diverted or directed off to one side or another. Trail users will avoid the eroded tread, fan out onto adjacent ungullied slopes, and cause trail widening and multiple tread development.

Trails that more closely follow the contour of the topography have a high slope alignment angle. These “side-hill” trails can be easily drained to their outside edge utilizing tread outsloping and various drainage structures. All else being equal, side-hill trails are much less susceptible to erosion than fall-line trails, simply due to their improved drainage characteristics. Their steeper side-slopes help confine visitor use to the constructed tread and facilitate tread drainage. Over time side-hill trails may develop a centralized dip in the traveled portion of their cross section, and a berm along the outside trail edge, both of which act to collect and direct runoff along the trail tread. However, these can easily be breached with waterbars or using rolling grade dips so that water is well dispersed and unable to erode the tread or the adjacent hillslope (Birchard and Proudman, 2000; Hesselbarth and Vachowski, 2000).

The ability to drain side-hill trails and to angle them to avoid steep trail grades makes them more sustainable, less subject to erosion, and less expensive to maintain over time. The slope alignment angle, once overlooked by trail designers and researchers, is now considered a fundamentally important component of sustainable trail development (Leung and Marion, 1996). The importance of slope alignment angle as an erosion indicator is related to the combined effect of trail drainage and trail grade. Steep trail grades are more closely related to trail erosion when the alignment angle is low, because water flows straight down the trail and cannot be effectively drained from the trail tread (Bratton et al., 1979; Gager and Conacher, 2001). Thus, as trail grades increase, the significance of a low slope alignment angle also increases. This is probably applicable to trails in most topographic positions, including trails that directly ascend valley bottoms, mountain-sides, and ridges (Leung and Marion, 1996).

Stream crossings and trail drainage – Stream crossings are the most common location for sediment from trail erosion to enter streams and cause water quality degradation and impacts to the aquatic system. Inadequate or poorly designed stream crossings have two major potential problems: 1) they can erode and fail during large flood events, and 2) they can exhibit high sediment delivery rates where descending trail grades deliver eroded sediment directly into the stream at the crossing site. Problematic stream crossing designs are easily recognized and identified, and resilient, low impact erosion-proof designs that protect aquatic resources while providing for improved user access can be employed.

A properly constructed side-hill trail design allows the greatest control over trail grades and effectively minimizes the most common and significant trail degradation problems near crossings: tread erosion, muddiness, widening, and secondary tread development (Agate, 1996; Birchard and Proudman, 2000; Demrow and Salisbury, 1998; Hesselbarth and Vachowski, 2000). Water on trails, including standing water and flowing water, is the leading cause of trail degradation. A sufficient frequency of grade dips, particularly on steeper trail grades, in mid-slope positions and on approaches to stream crossings, is necessary to prevent the accumulation of sufficient water to erode tread surfaces and deliver sediment to nearby streams. Employing a side-hill trail design across hillslopes permits effective control of both trail grades and trail drainage. Adequate tread drainage in the vicinity of streams and stream crossings prevents the buildup of larger, more erosive volumes of water and minimizes the discharge of fine sediment eroded from the tread to be delivered to the stream.

2.213 Use-related factors

To make informed decisions regarding the protection of natural resources and the need for visitor access, park managers must first evaluate the nature and magnitudes of potential resource impacts associated with proposed recreational activities, and then determine to what extent they are unacceptable and constitute impairment. This is not a straightforward procedure. Visitor traffic can compact soils, dislodge and displace compacted soils, widen trails, exacerbate problems with muddiness, and accelerate soil erosion (Leung and Marion, 2000). Leung and Marion (1996) reviewed over fifty recreation ecology studies and found that climate and geology, which affect topography, soil, and vegetation, combined with user type, intensity, and behavior, were the main underlying factors that influence trail conditions. The nature and magnitude of the various environmental and user-related factors, and their co-contribution to the observed trail impacts, is complex.

Research has generally shown environmental and human factors, rather than the total number of visitors, are the primary influencers of trail condition (Cole, 1987; Cole et al., 1987; Leung and Marion, 1996, 2000). Virtually all trail uses are associated with impacts, including erosion. However, the nature and magnitude of impact attributable to use-related parameters is complex and is not always easily differentiated from that attributable to environmental parameters alone. While there is general agreement about the importance of influencing environmental and human factors, recent research in some environmental settings shows more conflicting results as to the relative effects of these individual influencing factors (Nepal, 2003). Cole (1991) and Dale and Weaver (1974) found that trail width was positively related to the amount of use. Divergences from some of the other more common relationships appears to be most common with trail studies conducted in non-mesic, non-temperate environments, including high altitude snow-dominated settings (Nepal, 2003; Yoda and Watanabe, 2000), tropical environments (Sutherland et al., 2001) and arid environments (Tinsley, 1983; Tinsley and Fish, 1985). Divergences in our understanding of their relative importance may also occur in some urban public lands where visitor use is so high that use-effects completely overwhelm the capacity of the landscape to absorb the use.

The process of trail degradation and erosion begins with the construction of the trail tread. Surface erosion processes may initially be active on exposed soils within the alignment, until the tread and soils become compacted with use and vegetation stabilizes the trail margins. The natural geomorphic and hydrologic processes that occurred at that location are now altered (Bryan, 1977). Compaction and soil bulk density along the trial increases compared to adjacent soils, infiltration is reduced and runoff is increased on the tread surface, and springs and seeps may be exposed by excavation of the tread across the hillslope. Once a trail tread has been developed, soils that once contained or were covered with organic matter are now exposed and more vulnerable to natural geomorphic processes, including erosion (Coleman, 1981; Chappell, 1996). These geomorphic processes can be accelerated by trail use to the point that hikers avoid impacted areas and thereby cause widening of the trail tread and other off-trail impacts (Bryan, 1977).

The trail degradation process may appear simple at first glance. However, each part of the overall processes (e.g., initial disturbance, alteration of natural hydrologic/geomorphic processes, and imposition of various user stressors) can be complex and their interaction results in a process that is multivariate (Ferguson, 2005). First, there are environmental variables that act on that particular site. Then, there are disturbances and alterations to those processes initiated by trail construction and trail management. Finally, users affect the site though their recreational activities.

Research has shown that many trail problems are the result of poor planning and initial location rather than higher impacting types and amounts of use (Cole, 1987; Leung and Marion, 1996, 2000). Environmental variables are generally thought to be more important to the occurrence of erosion on established trails than are user variables (Marion et al., 2006). They point out that although an individual trail receives the same types and intensities of use uniformly along its length, its condition may vary from good to poor condition in different locations. Some instances of trail erosion and degradation can occur without visitor use, such as gullying on long, low angle fall-line trails that cannot be drained. Although these examples seemingly imply the singular importance of environmental factors in trail degradation, trail use by visitor traffic is what actually triggers deterioration in some environmentally susceptible trail locations. Without the application of visitor use many trails may show little or no significant deterioration. For example, muddy trail sections and associated trail widening will not occur without visitor use.

General use-related impacts related to erosion

Leung and Marion (1996) have examined the nature and causes of trail widening, incision, compaction, and soil loss. Common to all non-motorized trail uses (principally hiking, horse riding and biking), the four primary forms of trail degradation include; 1) compaction, 2) muddiness, 3) displacement and 4) erosion. Marion and Wimpey (2007) summarized the basic trail impacts, including erosion, generated by non-motorized visitor use on trail systems as follows:

Compaction - Compacted soils are denser and less permeable to water, which increases surface runoff during rainfall events. In the context of trail use by park visitors, soil compaction is caused by the weight of trail users and their equipment transferred through feet, hooves, or tires to the tread surface (Marion and Wimpey, 2007). However, compacted soils also resist erosion and soil displacement and provide durable treads that support traffic. From a durability perspective, soil compaction is considered a beneficial and unavoidable form of trail impact. Trails act to focus and concentrate visitor use onto a narrow tread and this reduces stressors and impacts to other off-trail areas. Success in achieving park-wide resource protection will necessarily result in higher levels of soil compaction on designated visitor access routes.

Unless soils are mechanically compacted during trail and tread construction, initial visitor use will result in compaction along portions of the tread that receive the greatest traffic, generally the center. The compaction and lowering of the tread surface, even on outsloped roads and trails with a high slope alignment angle, can create a cupped cross-section that intercepts, collects and diverts surface runoff. In flat terrain this water can pool or form muddy sections, while on sloping trails the water is channeled down the trail, increasing its potential to cause erosion. In early trail impact studies the origin of this cupped cross section was sometimes mistaken as being entirely caused by erosion. Erosion on roads and trails with “cupped” or rutted cross sections can be effectively prevented or controlled by the use of waterbars, rolling grades or other cross drain structures.

Muddiness – Trail muddiness is a combined function of excessive moisture, fine grained or organic-rich soils, and poor drainage, punctuated and made worse by visitor use. Trails located in areas of poor drainage or across highly organic soils that hold moisture, are likely to be plagued by persistent muddiness. Muddiness is most common in flat and low lying areas where water accumulates and soils have poor drainage. On sloping trails, soil compaction, displacement, and erosion can exacerbate or create problems with muddiness by causing cupped treads that collect water during rainfall or snowmelt. Horse traffic can disaggregate the surface of a compacted trail, producing small depressions and loosened soil that retains standing water and turns muddy with traffic. Subsequent user traffic avoids these degraded areas, widening the disturbed area or creating braided trails that bypass muddy sections.

Displacement – Over time, or as a function of specific trail uses, visitor traffic can also push soil laterally causing displacement and development of ruts, berms, or cupped treads. Soil displacement in most environments is a minor process, but can become more evident where soils are damp, or dry and loose, and users are moving at higher rates of speed (usually on bicycles) or on horses. Churning caused by feet and hooves, and turning and braking by wheeled vehicles, can displace soil and move it to the trail margins. Regardless of the mechanism, soil is generally displaced from the tread center to the sides, elevating berms, compounding drainage problems and eventually resulting in the collection and concentration of runoff down the trail tread.

Erosion - Soil erosion consists of particle detachment and subsequent downslope transport processes. Natural processes that cause erosion include rainfall (raindrop impact), surface runoff, freeze-thaw and gravitational processes (dry ravel). Bare, unsurfaced trail treads are exposed to weather and will thus experience erosion unless the exposed soil is covered by mulch, rock, vegetation, or other protective surfacing. As long as trail treads are largely unsurfaced they will experience some surface erosion. Loose, fine grained, uncompacted soil particles are most prone to soil erosion, so trail uses that loosen or detach soils contribute to higher erosion rates.

Water is the most significant erosional mechanism in most settings, including arid and semiarid environments. Water acts to erode trail surfaces in several ways. Most trail erosion is caused by direct rainfall and by subsequent surface runoff flowing down the trail surface. Poorly drained trails collect and concentrate surface runoff, increasing the potential for soil erosion as trail drainage area and trail grades increase. Trails with steep grades and large undrained collection areas are prone to erosion. To avoid or minimize erosion, sustainable trails are generally constructed with a slightly crowned (flat terrain) or outsloped (sloping terrain) tread to discharge surface runoff from the trail as quickly as possible, and fitted with cross drains to break up and disperse surface runoff. Properly designed drainage features or structures are constructed to divert water from the trail before it has the ability to cause significant tread erosion, and at a velocity sufficient to carry any sediment load beyond the tread where vegetation and organic litter can filter out fine sediments. Just as with a road, a well designed and constructed trail should exhibit minimal cumulative soil loss (e.g., Marion and Wimpey, 2007; Cole, 1991; Tinsley and Fish, 1985).

Site specific studies indicate the importance of rainfall intensity and slope gradient (driving factors) as key factors in explaining variations in soil loss on trails, and that soil properties such as structure, texture, and moisture content (resisting factors) determine the resistance to erosion and play secondary roles. Overall, research has demonstrated the difficulty of quantifying the multivariate relationships between natural variability, recreation activities, and trail erosion rates. Although several studies show trail degradation occurs regardless of specific uses and is more dependent on the geomorphic processes that occur in different landscapes (Summer, 1980), most research studies have focused either on established trail segments subject to multiple uses or on plot experiments that attempt to isolate and evaluate only one type of trail use under constant environment conditions.

<u>User-type and user-intensity impacts related to erosion</u>

The basic formula for locating, constructing and maintaining stable, low impact recreational trails is reasonably well understood for most environments. Except where hiking use is extremely high, it is probably rare for the impacts of hiking on trails to exceed the impacts caused by trail construction (Cole, 2004). Regardless, some locations along trail alignments are more environmentally sensitive to change than others and may show various degrees and types of degradation under climatic or visitor use stressors.

The types of research that have probably been most useful to management are studies of the factors that influence the magnitude of these impacts – why impacts are minor in some situations and severe in others (Cole, 2004). For well-located and properly drained trails, post-construction erosional impacts would probably be minimal in the absence of visitor use. Thus, if a properly designed and drained trail or road is left unused for long period of time, the erosional impacts of its features gradually diminish over time as the bare surfaces stabilize to local conditions and the exposed surfaces revegetate.

Like a newly built road, most erosional impacts on trails occur in the immediate post-construction period. Erosion along well designed trails then quickly diminishes to a comparatively low level as exposed surfaces harden or become vegetated. By design, trails are bare, compacted surfaces. Adding visitor use to a newly constructed trail increases the churning and subsequent erosion of the trail surface. To varying degrees, hiking, horse riding, and biking on a trail surface is a disturbing activity that perpetuates the bare tread surface and influences subsequent erosion during rainfall and runoff events. Two early experimental studies have provided insight into this process. They show that sediment yield and trail erosion is detachment-limited rather than transport-limited (Wilson and Seney, 1994; Deluca et al., 1998). Trail use loosens soil particles, making them easier to detach and, therefore, available to be transported by running water (Cole, 2004).

Cole (2004) identified four principal factors that influence intensity or magnitude of impacts, three of which are related to visitor use: (1) type and behavior of use, (2) frequency of use, (3) season of use, and (4) environmental conditions. For the purposes of this review, the primary user-related factors influencing trail erosion can be broadly categorized into three main components: *user type*, *use intensity*, and *user behavior*.

Since the late 1970s, a general consensus has developed about at least five use-related impacts (Cole, 2004). These have implications for trail management and for preventing or controlling accelerated use-related erosion and its effects:

- Impact is inevitable with repetitive use (and the greatest impacts are likely to occur where environmental variables are most sensitive);
- Impact occurs rapidly, while recovery occurs more slowly (implying that trail impacts should be avoided or managed proactively because damage can otherwise be long lived and recovery difficult);
- Impact often increases more as a result of new places being disturbed than from the deterioration of places that have been disturbed for a long time (most well established trails and trail segments are likely to be stable under existing conditions, suggesting it is more important to inventory impacted trail sites, new social trails, and trails undergoing a change in use than it is to monitor for change on well established trail);
- The magnitude of impact is a function of frequency of use, the type and behavior of use, environmental conditions and the spatial distribution of use (many of these user and environmental variables are amenable to management manipulation using a variety of possible techniques to lower site stress and reduce or eliminate potential or developing trail impacts);
- The relationship between the amount of use and the amount of impact is usually curvilinear (asymptotic), with most impacts occurring under low use levels and per-capita impact decreasing with increased levels of use (thus higher levels of use do not typically result in an equally elevated levels of impact). Some exceptions to this relationship include the addition of higher impact types of use (e.g. horses or motorized uses) and trail use during wet seasons (Marion et al., 2006). Thus, adding a new high-impact user type to a trail is likely to be accompanied by an increase in trail degradation as the trail adjusts to the altered, increased disturbance regime of that use.)

User-type impacts related to erosion

The three main non-motorized user-types that have received attention in the scientific literature include hikers, horse riders and mountain bikers (Deluca et al., 2010). Each of the activities comes with its own disturbance regime and user-related influences that affects the trail corridor and tread in different ways and to different degrees. The uses have some of the same mechanical effects on the trail, but the impacts from one use to another can vary significantly in severity with use intensity and environmental setting (e.g., Cole, 1989; Newsome et al., 2004).

Hiking - Some of the earliest quantitative trail impact and trail erosion studies were those conducted on hiking trails in wilderness areas (Cole, 1983). David Cole has been prolific in his attention to the subject of wilderness impact assessment (see Leung and Marion, 2000). Although erosion can be significant on parts of the trail system, studies in Montana and Texas showed that little erosion is occurring on the trail system overall (Cole 1991; Tinsley and Fish 1985). Some parts of the trail will be experiencing erosion, some will be experiencing deposition, while other parts show little change or effectively act as transportation corridors for sediment derived elsewhere (Summer, 1986). Often, soil that is eroded from trail cutbanks or the tread itself is deposited elsewhere on the trail. Eroded soil is eventually discharged off the trail system only where water drains naturally or through drainage structures (Cole, 1990). Although trail systems as a whole usually exhibited a relatively steady state, the critical segments for impacts, and for management responses, are where erosion is most pronounced.

Studies of human trampling on both undisturbed sites, experimental plots and along established trails have been extensive and diverse. For example, the biophysical trampling motions of hiker's feet were described by Holmes (1979) and Quinn et al. (1980). The effects of different types of hiking boot soles on surface soils were compared by Kuss (1983). Quinn et al. (1980) described that soil surface damage from feet was caused first by the downward compaction forces from the heel, and then from rotational shearing forces from the toe as the step is completed. They found shearing action to be most important in producing soil deformation when traveling in the upslope direction. Weaver and Dale (1978) and Weaver et al. (1979) found that downhill stepping (by foot and hoof) was more erosive than downhill motorbiking. This was due to the greater downward forces exerted through the heel-first action in down-stepping on a slope.

The primary effect of human trampling is to make a trail susceptible to erosion by loosening the soil surface (Deluca et al., 1998). Hiking on established trails dislocates some soil and provides local compaction, thereby reducing infiltration rates. Other than by minor physical displacement, especially evident on steep slopes, water runoff during rainfall events is most responsible for the subsequent erosion and sediment transport along the trail tread. Overall, the amount and type of hiking trail use have been generally found to be less important than grade, orientation, and drainage on the trail tread (factors that affect the channelization and erosive force of water) and soil texture (the primary factor determining soil detachability). Studies in the northern Rocky Mountains concluded that trails were not substantially deeper where use levels were higher (Cole, 1991; Dale and Weaver, 1974), although trail widening was found to increase with increasing visitor use. Beyond a low threshold of use, location and design have been found to be more important determinants of erosion than amount of use (Cole, 1991).

Horse riding - There are fewer studies on the biophysical impacts of horse riding than there are on hiking, and even fewer on the erosion impacts and consequences of mountain biking (although that is changing). Research clearly shows that trail users are not equivalent in the extent to which they contribute to soil detachment and accelerated erosion. The type of use (e.g., hiking, horse riding, biking) can profoundly affect both the nature and magnitude of the resultant impact. Research clearly shows that the mechanical process imparted by horse riding on trails is similar to that of hikers (surface disturbance, churning and displacement on sloping treads, and compaction on level ground), but the magnitude and severity of that effect is much greater with horses (Weaver and Dale, 1978). Horses cause more impact than hikers or llamas (Deluca, et al., 1998; Whittaker, 1978), which were found to cause equivalent levels of impact (Deluca et al., 1998; Cole and Spildie, 1998). In mixed use studies, the type of use has been shown to be a significant determinant of the type and extent of trail impacts. Wilson and Seney (1994) evaluated tread erosion from horses, hikers, mountain bikes, and motorcycles. In this experiment, horse traffic resulted in the largest sediment yields, under both wet and dry soil conditions. Dale and Weaver (1974) found that horse trails in Montana are deeper but equivalent in width to hiker trails.

The presence of horse traffic on a trail system is an important indicator of potential erosion problems (Cole, 1990). With the small bearing surface and heavy weight of horse and rider (or packs), a horse's hoof can generate pressures of up to 1,500 pounds per square inch (Bainbridge, 1974), over ten times greater than for a hiker's boot (Liddle, 1997). Horses' hooves are typically shoed with metal. The sharp shoes and a rotating hoof action cause stock to break up, not compact, the trail surface, especially on sloping trails and on trails composed of uniform fine grain sediment that is low in rock content. Detached soil generated by horse traffic is more easily eroded than soils on compacted hiking trails. Because of the small carved depressions created by hoofs, water tends to pool in the footprints of horses on flat and gently sloping trails, making them muddier than hiking trails after rainfall. In an experimental study, Deluca et al. (1998) found that horse traffic resulted in much higher sediment yields (an indicator of erosion potential) from established trails than either hikers or llamas (Cole, 1990).

Trail designs and disturbance profiles may also be different if horses are to be accommodated. For example, in Great Smokey Mountains National Park, sustainable trail designs call for a 24" to 48" tread width for hiker/horse trails, and a 12" to 30" tread width for a hiker-only trail (NPS, 1995). If it is fully utilized, the extra tread width can result in a wider corridor of disturbed ground, more soil exposure, and greater erosion potential. In lower use areas, trail widths may not differ significantly between horses and hikers. In a number of settings, old abandoned roads once built for mining, forestry, ranching or homesteading are now used as hiking or multiuse trails. Active tread width in these settings typically tends to reflect the original road width rather than the single lane tread that would otherwise be used (NPS, 1995). Wide roads with heavily compacted surfaces tend to result in wide trails with side-by-side travel and a wide and potentially erodible tread. Provided they are maintained and do not traverse steep slopes, converted roads and railroad grades may be capable of sustaining relatively high levels of use by horses and vehicles (Upitis, 1980, as cited in Landsberg et al., 2001).

Well established existing trails with high rock fragment content in the upper soil horizon may be relatively stable under horse traffic. In a trail study in Rocky Mountain National Park erosion rates on horse trails were found to be indistinguishable from rates measured hiker-only trails (Summer, 1980). As noted in other studies, new trails were found to be particularly prone to deterioration and their condition was often related to terrain characteristics rather than use patterns. Summer (1986) described the mountain trails as "conveyor belts" for sediment transport between upper segments eroding and lower segments experiencing net deposition over time. Over the monitoring period, intermediate trail sections varied between soil loss and soil accumulations, depending on whether or not material is currently being transported though the reach. The trails found to be most vulnerable to horse traffic were those that crossed loose colluvial slopes and unconsolidated moraine sideslopes, as well as wet bogs, and high altitude alpine areas. Trails on level valley floors and terraces with well-drained soils were resistant to erosion, but susceptible to trail widening over time.

On backcountry trails in Montana, Deluca et al. (1998) found that bulk density on horse trails was negatively correlated with sediment yield and that surface roughness was positively correlated with sediment yield. Results from their experimental plot study supports other findings that describe soil loosening as the primary disturbance mechanism contributing to increased soil erosion caused by horse traffic. In comparison, they found that horse traffic consistently made more sediment available for erosion from trails than llama, hiker, or no traffic. This relationship of markedly elevated sediment yield for horse traffic was confirmed for plots with low and high intensity use, as well as for plots with wet and dry soils. Because of their course texture, soil churning occurred on plots with both wet and dry soils, but was more pronounced in dry soils.

In response to trail traffic on the experimental plots, accelerated erosion occurred as the combined effect of increased runoff, increased channelization of runoff, increased soil detachment from the disturbed surface, and increased transport of the detached soil particles. This supports Wilson and Seney's (1994) finding that sediment yield, at least in this experimental setting, is detachment-limited rather than transport-limited. Detachment of particles was dependent on horse traffic and was found to be the most important contributing factor to increased sediment yield. Although runoff rates from all plots were found to be similar, runoff from areas of horse traffic carried a significantly higher sediment load compared to the other types of traffic.

In general, moist soils are considered to be particularly vulnerable to trail problems (Hammitt and Cole, 1998). Thus, Wilson and Seney (1994) found sediment yields to be higher on plots were the soil had been pre-wetted. In contrast, Deluca et al. (1998) found greater horse-cause churning, reduced soil bulk density, and subsequently increased sediment yield coming from plots with dry trails compared to pre-wetted trails. In these soils, water was found to have increased soil cohesion and thereby reduced soil loosening during periods of horse traffic, thereby reducing the amount of loose soil that was available for erosion and sediment transport during precipitation and runoff events.

When horse traffic encounters treads with saturated soil conditions, the amount and type of equestrian use are of little importance. Because of their heavy weight and small bearing surfaces a small amount of traffic is sufficient to quickly create a deep, muddy tread. Trail damage is much more rapid with horses than with hiker use (Stanley et al., 1979). Muddiness can be a season-long or short term tread problem, depending on the period of saturation. If the water table is always close the ground, or if the trail is relatively high elevation or north facing so that snowmelt occurs over an extended period, the trail can remain vulnerable to damage for extended periods. The season of use is a less critical factor for hikers than it is for horses and heavy pack animals, largely due to their relative sizes, although hikers can still cause significant trail damage and erosion when soils are saturated.

Mountain biking – Compared to hiking and horse riding, mountain biking on backcountry and parkland trail systems is relatively new recreational activity. Because of this, scientific research and peer reviewed publications on the environment effects of mountain biking is still limited (Marion and Wimpey, 2007). This has likely contributed to the divisive nature of the debate among user groups, managers, and conservationists (Newsome and Davies, 2009; Deluca et al., 2010). In fact, social research focusing on user conflict has received perhaps more attention than the biophysical effects of mountain bike use (White et al., 2006; Hendricks, 1997; Cessford, 2002). Deluca et al. (2010) suggests there is insufficient research on the biophysical impacts of mountain biking to authoritatively assess their relative impacts compared to other trail uses, especially because of the variable riding styles and user behaviors that may accompany mountain bike trail use and affect trail impacts. A number of recent literature reviews have described the state of the science on the ecological and environmental impacts of mountain biking on trails and untracked areas (Cessford, 1995; Marion and Wimpey, 2007; Deluca et al., 2010; Quinn and Chernoff, 2010).

Although the ecological effects of mountain biking are less well understood than for other trail uses, the basic processes are amenable to analysis. Cessford (1995) reviewed the forces and impacts of mountain biking. Like feet, wheels exert compressive and shearing forces on surfaces, but the transmission of these forces to trail surfaces by wheels is different from that of feet. No comparable vertical rotational forces are exerted with tires as exist with feet and hooves; so soil churning effects are much reduced. Wheeled travel largely involves downward compressive pressure, with lateral shearing occurring only to the point where riders are unable to move forward under their own power. Mountain bikers cannot generate the degree of sustained torque that is generated by powered motorbikes, and significant rotational wheel-slip for them can only occur on very wet or unconsolidated surfaces.

In an early experimental study on user impacts, including hiking, horse riding, mountain biking and low power motorcycles, Wilson and Seney (1994) found that only horses caused significantly more sediment yield than control sites or other uses under both wet and dry conditions. They established trail plots, applied several intensities of trail use by the four user-types, applied artificial precipitation, and measured resulting sediment yields. Sediment yield from existing trails was found to be detachment-limited rather than transport-limited, with horses and hikers (hooves and feet) making more sediment available for erosion than motorcycles and off-road bicycles (wheels). In their study, horses and hikers contributed more to sediment movement through their stepping action than did either motorcycles or off-road bicycles. This effect was most pronounced when trails were wet. Because of the limitations of the experimental design (rainfall intensities were low and passes were limited) extrapolation of the results may be limited (Deluca et al., 2010).

Marion and Olive (2006) studied trail impacts on a multi-use trail network and found that of all types of trails, bike trails were found to be the narrowest, to have the least amount of soil loss, and to have the least incidence of running water on the trails. They reported that trails with heterogeneous soil composition (including rocks and gravel) were less susceptible to erosion than trails over more homogeneous, finer-grained soils. Goeft and Alder (2001) noted a seasonal effect on soil erosion with greater impacts occurring during rainy seasons. Deluca et al. (2010) has generally cautioned that non-experimental trail survey studies contain the underlying assumption that there is a cause-and-effect relationship between predominate trail use and trail condition, and that other factors need to be considered.

White et al. (2006) also examined recreational trails predominantly used for mountain biking on public lands in five ecological regions of the Southwest. They examined and measured trail dimensions at 319 sample points along 163 miles of trail. Two trail condition indicators, tread width and maximum incision, were assessed at each sample point. Results show that erosion and tread width on these trails differed little in comparison to other shared-use trails that receive little or no mountain biking use. Results were also consistent with previous mountain bike trail research (Goeft and Alder, 2001; Wilson and Seney, 1994) showing that increasing trail slope was associated with greater tread incision.

Many studies suggest that the site, situation, and landscape characteristics of a trail have more potential to affect soils than the actual nature of the activity (Quinn and Chernoff, 2010). Although more research needs to be undertaken on identifying and addressing the physical impacts of mountain biking, the present state of knowledge suggests that the physical impacts of recreational mountain bike touring are generally not significantly greater than those caused by other recreational uses, including hiking (Cessford, 2002). It is even possible that in some situations the impacts caused by walkers, who transfer their weight from foot to foot and from heel to toe, may be greater than the impacts caused by mountain biking where the weight is evenly loaded over two wheels (Goeft and Alder, 2001). Thurstan and Reader (2001) found no significant differences between the vegetation and soil impacts from hiking and mountain biking, though they speculated that behavioral differences between the two groups could contribute to the belief that mountain biking has led to trail degradation problems.

Existing studies suggest that mountain biking and hiking activities do not differ significantly in magnitude under most conditions and trail settings. The general consensus from the few comparative studies is that the trampling impact is greater on slopes than on level sites; on wet rather than dry surfaces; and that it tended to be greatest for hikers and horses moving downslope, and motorbikes moving upslope. Lack of torque limits the ability of mountain bikes to cause the magnitude of soil displacement and impact of motorized vehicles. Such loss of traction for a mountain bike causes a halt to forward progress and cannot be sustained meaningfully. While they cannot usually generate the uphill erosive channeling found for motorcycles, they can have a similar effect on downhill slopes, most particularly when the surfaces are unconsolidated and wet, or when hard braking and skidding is involved. This type of impact is unique to wheeled vehicles, and appears to be the major source of impact potential unique to mountain bike use (Cessford, 1995).

With mountain bikes, behaviors such as downhill skidding can loosen track surfaces, move material downslope, and promote the development of ruts that channel water-flow. The development of wheel ruts from repeated skidding on steep trails can promote channelized, erosive water-flows to a greater extent than downhill foot traffic. Wheel ruts are the most distinctly unique "wheeling" impact and are often identified as the most obvious evidence of mountain bike impact on trails (Cessford, 1995; Chavez, 1997; Horn et al., 1994). Braking and skidding, either deliberately or accidentally around a sharp corner, increases the rate of soil displacement and mechanical erosion (Chiu and Kriwoken, 2003; Marion and Wimpey, 2007). Steep slopes and corners have been identified as the susceptible locations where mountain bikes can increase the potential for soil erosion (Goeft and Alder, 2001).

In contrast to hiking and horse riding, mountain biking is not homogenous activity, and impacts may be imparted from the activity, as well as the manner in which the riding is performed. To date, mountain bike impact studies have largely focused on soil erosion and degrading trail conditions from tour-like mountain bike activities, either through experimental plot studies or by impact inventories conducted along established trail systems (Wilson and Seney, 1994; Olive and Marion, 2009). Where skidding does not occur, early research suggests the impacts caused by mountain bike use and the normal rolling effects of wheels on trail are generally comparable in magnitude to those of hikers in the same settings (Cessford, 1995; Wilson and Seney, 1994; Grost, 1989; Chavez et al., 1993; Marion and Olive, 2006). However, more aggressive riding styles may impact trail and off-trail environments. These include including cross country, downhill, free style and dirt jumping, all of which are likely to impart difference levels of impact to the tread surface and immediately adjacent off-trail areas. The true extent and severity of mountain biking may be connected with a number of user behaviors including faster riding, descending steep slopes, less controlled movement (jumping, braking, skidding, and fast cornering), and off-trail riding. Research that isolates the biophysical effects of the more aggressive riding behaviors and styles has not been reported in the scientific literature. Regardless, maintenance practices (such as trail obstacles), educational efforts and enforcement have all been employed to control unwanted user behaviors in areas where it occurs.

When considering different types of activities, such as adding mountain biking or another use to an existing hiking trail, the main question is whether some of the proposed new uses are likely to cause disproportionately greater levels of impacts than others. Given that most trails were originally developed within the tradition of walking use, the addition of biking as a new or expanded form of use, with a new array of potential impact types, may present a particular problem for managers concerned with trail maintenance. With the types of impacts noted above, research indicates that the location of the trail and the condition of its construction through environmentally susceptible areas is likely more important in the occurrence of impacts than the type of activity present (Cessford, 1995; Leung and Marion, 1996). Physical impacts and erosion problems that arise are more likely to be the effects of greater use-levels overall, or from trails passing through physically sensitive environments, particularly where they are related to poor trail drainage characteristics. Excessively steep pitches, long sloping runs, and other trail characteristics that encourage or allow excessive speeds may indirectly result in localizing trail impacts caused by rapid turning and braking. These may be proactively addressed through a number of trail management practices.

Numerous studies have documented a curvilinear relationship between amount of use and most forms of trail impact (Cole, 1983; Sun and Liddle, 1993; Weaver et al., 1979). Initial or low levels of trail use, or beginning uses on a newly constructed or relocated trail, will result in the majority of use-related impact, with per-capita impacts diminishing as use increases. For example, vegetation and organic litter are either removed during trail construction or are quickly lost from social trails receiving even light traffic. As a trail hardens and compacts with age, further traffic causes comparatively less additional impact, particularly on trails with adequate maintenance to control water runoff and tread widening.

Mountain bikes have the unique ability to cover long distances quickly, and to affect near-trail and off-trail areas through user-wandering. There are references in the scientific literature to cross-country bike use in some areas, but little documentation of the extent or frequency of this behavior. While mentioned, there is little published information about the frequency with which mountain bikers employ or develop trail cutoffs or shortcuts compared to other users. An important management implication of the curvilinear use-impact relationship is that substantial degradation of off-trail areas and social trails can occur quickly and will need to be monitored and controlled to minimize soil disruption and consequent erosional impacts. Likewise, if erosional impacts are occurring on well used trails, substantial reductions in use must occur to achieve any significant reduction in impact. Thus, removal of a single user type on that trail may not result in significantly reduce trail impacts. Reduction of erosion or other trail degradation variables are more likely to be most successful through maintenance, drainage, or erosion control measures, or relocation of the eroding trail segment to a more stable and resilient location.

User behavior impacts related to erosion – A number of user behavior effects have already been discussed in relation to trail use. Some specific impacts, such as trail widening and creation of parallel treads (trail braiding) or side trails are strongly influenced by user behavior (Hammitt and Cole 1998). Visitors seeking to avoid severe rutting or rockiness caused by soil erosion or muddiness often cause trail widening by going off-trail. Visitors traveling side-by-side rather than single file also contribute to this problem, and this user behavior is often encouraged by excessively wide trails or the use of old roads as trail alignments. Hiker and horse rider behaviors that impact erosion processes are mostly related to the avoidance of obstacles or adverse trail conditions, such as ponded water, saturated soils, muddy sections, heavily eroded trail surfaces, exposed rocks or roots and other sources of uneven trail tread. Most of these behaviors are obstacle avoidance responses and not recreational experience choices. In contrast, trail cutting and off-trail travel can be a significant recreational or user-choice activity that results in off-trail impacts and accelerated erosion.

In the scientific literature, the most commonly described user behaviors with erosion impacts are those attributed to mountain biking. Although mountain bike touring is described in the limited scientific literature as causing a comparable level of physical impact to hiking, and less impact than horse riding in most settings, mountain biking impacts will increase when users employ skidding, sharp corning at speed, and travelling on steep slopes and wet soils (Cessford, 1995). The different riding styles (including cross country, downhill, free style and dirt jumping) are likely to impart different levels of impact to the trail surface and nearby off-trail areas. Research on the nature, frequency and impacts of these recreational activities and their associated impacts has not been reported in the peer reviewed scientific literature and thus remains a highly discussed but poorly understood topic in trail degradation studies. In contrast to the activities of hikers and horse riders, these user-behaviors are largely unique to mountain biking.

Modification of environmental and use-related factors
According to Leung and Marion (2000):

> "Most recreation ecology investigations have focused directly on relationships between use-related and environmental factors and fail to consider management interventions that seek to manipulate these factors. The effectiveness of management actions in avoiding or minimizing visitor impacts represents a significant topic of considerable importance to managers. More research is needed in high-use areas to assess the magnitude of impacts and evaluate the effectiveness of management actions in more intensively visited locations."

They have described a suite of management actions that can be employed to minimize and eliminate some of the most common causes of recreational impacts in wilderness areas, including trail degradation and erosion. These managerial actions can be extrapolated into useful techniques to be employed in most natural areas and allow managers to locally minimize the individual or combined effects of environmental variables and user activities. The effectiveness of these management actions have received relatively little research attention in the scientific literature compared to the more classical studies on trail impact cause-and-effect relationships.

Management interventions occur when trail impacts are judged to be excessive or threatening natural resources. They are employed to avoid or minimize recreation impacts by manipulating either use-related or environmental factors. Management of use-related factors, including the redistribution or limitation of visitor use or the control of unwanted user behaviors, has received more research and management focus. The modification of visitor behavior through educational and regulatory actions is a frequently applied strategy. However, scientific studies have increasingly demonstrated the importance of environmental factors in contributing to trail impacts and degradation such as erosion (Leung and Marion, 1996). Management actions include focusing trail use in environmentally resistant locations, avoidance of sensitive or "weak" areas, employing trail designs and maintenance actions that reduce or eliminate the primary causal factors of trail degradation (e.g., improved drainage), or increasing resource resistance through the use of hardening and other engineering and maintenance facilities (Cole, 1990).

Modification of Use-Related Factors - Managers can control or influence amount of use, density of use, type of use, and user behavior through various actions (Leung and Marion, 2000). Careless, unskilled or uninformed actions are often addressed through visitor contacts and education responses (Lucas, 1982). Unavoidable impacts are commonly reduced by relocating visitation to resistant surfaces, by limiting visitor use, or by maintenance actions that address the environmental variables. Intentional behaviors that result in resource impacts, such as trail cutting and environmentally damaging riding practices, may be addressed through enforcement and/or more direct practices that remove opportunities to perform the damaging behaviors.

1) Amount of use - Amount of use is perhaps the most studied use-related factor and research has consistently found a nonlinear, asymptotic relationship between amount of use and amount of impact (Cole, 1987). This implies that removing use from a well used trail is unlikely to have a significant remedial effect unless the reduction is substantial, and then only modest reductions in impact should be expected. At lower levels of use (such as an unwanted trail cutoff or social trail development) reductions in use are more likely to result in significantly improved rates of resource recovery (Cole, 1995). The reductions might occur through limiting overall visitor

number, reducing or eliminating certain user types, or seasonal limitations employed during times when resources are more vulnerable to impact, such as periods of soil saturation.

2) Density of use – The spatial concentration of visitor use affects both the aerial extent and severity of resource impacts (Marion and Cole, 1996). It is traditionally applied to wilderness camping, but is applicable to tail use as well. For example, some trails might be used excessively, while others remain under-used. Similarly, some points of trails, such as overlooks and streamside areas, might receive greater impacts because visitors wander off-trail in those locations or simply remain in those spots longer than others. Visitor concentrations can be managed either by visitor dispersal (employing sufficient trail opportunities to keep use levels low) or by containment strategies (e.g., concentrating use on resilient trails and off-trail areas). The development of formal trail systems is one obvious form of visitor containment, where users are intentionally directed across the most resilient part of the landscape and away from resources that are most in need of protection. Containment can also be employed seasonally and spatially by employing selected and specific trail closures during periods, and in locations, where environmental degradation is most likely to occur. Dispersal, often used in camping management, is rarely used to reduce hiking impacts but may be appropriate for high impact uses such as horse riding where use can be decentralized or spread to resilient routes (Leung and Marion, 2000).

3) Type of use - Types of uses that result in greater or disproportionate impacts, or impacts that might otherwise be unacceptable because of the sensitivity of the resource or because of its low resistance to disturbance, are often subject to special regulations or educational programs. For example, visitors with horses have been restricted to a subset of more resistant trails specifically selected and maintained to sustain such use (Marion et al., 2006; Landsberg et al., 2001; NPS, 1995; Newsome et al., 2004).

4) User behavior – Some user impacts are avoidable, often caused by uninformed or careless behavior (Lucas, 1982), and managers can effectively solve these problems through education and light-handed trail management practices. A variety of low-impact hiking practices have been described to address these impacts (Cole, 1989; Hampton and Cole, 1995), along with alternative education techniques for conveying such practices to visitors (Doucette and Cole, 1993). Where damaging trail impacts are the result of intentional user behavior, regulations and enforcement are employed to alter visitor behavior to reduce impacts (Lucas, 1982). In the most extreme, resource-damaging instances, and although it is often accompanied in spite of visitor objections, management has the option of temporarily or permanently closing impacted trails to all visitors, or to a class of users, if their damaging behavior cannot be reasonably and cost-effectively controlled.

Modification of Environmental Factors – The most effective way to "modify" the potentially adverse effects of environmental variables is to avoid locations where those factors are likely to result in trail damage or excessive erosion. Trails can be constructed or re-routed to and through areas that are known have soils that are resistant to erosion, that contain comparatively resilient vegetation, and that minimize the potential for visitor use to damage sensitive biological or cultural resources. Soils and geologic materials vary greatly in their resistance to detachment (erosion) and transport (Hammitt and Cole 1998; Kuss et al. 1990). Where soils are fine grained and prone to churning, displacement, and subsequent erosion, trail hardening techniques can be employed. If resources or materials are not available or cannot be used for hardening, user restrictions may be employed to eliminate disturbance and effectively meet site resistance limitations.

If trails are high in organic matter and subject to saturation, trail management can be employed to design improved drainage systems or to locate an alternative route to bypass the problem area. Trails may be originally designed to avoid areas prone to muddiness, fragile vegetation types, and steep slopes or erodible soils, and to seek areas of favorable topography and vegetation. Although trail impacts are ideally reduced through careful site selection, design, and construction, most pre-existing trails have to be managed according the environmental variables that currently exist within their alignment. This elevates the importance of preventive and corrective maintenance, and the use of effective, low maintenance erosion control and trail drainage practices to make trail more resistant to erosion and degradation.

Research-supported trail management practices are now sufficient to direct visitors to trails able to sustain heavy recreational traffic with far less resource impact and site erosion than previously occurred (Leung and Marion, 1996, 2000). Sound maintenance and visitor management techniques can also contribute substantially to the avoidance and minimization of recreational trail impacts. Many excellent Best Management Practice manuals have been developed to guide this work (Birchard and Proudman, 2000; Demrow and Salisbury, 1998; Hesselbarth and Vachowski, 1996). User education and management practices can be employed to minimize unintended trail degradation and impacts. Active trail maintenance reduces impacts by providing a durable tread for the intended traffic while minimizing problems with the main types of biophysical trail degradation: tread muddiness, erosion, widening and multiple tread development. Trail closures represent a final resource protection strategy, generally most appropriate for protecting the most sensitive environments, rare flora and fauna or fragile historic sites (Leung and Marion, 2000).

3. MODELS AND METHODS USED TO EVALUATE SOIL EROSION IMPACTS

A variety of models and methods have been utilized to evaluate the impacts of road and trails on soil erosion. These approaches depend on specific environmental and trail use criteria that influence the magnitude and extent of soil erosion. The existing literature presents two basic approaches to evaluating soil erosion from road and trail impacts: (1) soil erosion is evaluated solely on environmental criteria (e.g. rainfall, topography, and soil characteristics) and (2) soil erosion is assessed using both environmental criteria and user criteria (e.g. user type, level of use, and season, and length of use).

The following section discusses several methods to assess soil erosion hazard in the context of road and trail impacts, evaluates their suitability as a tool for evaluating potential road and trail change in use projects, and suggests the most appropriate method for evaluating soil erosion hazard and the impacts of road and trail change-in-use proposals for the State Parks PEIR.

3.1 ENVIRONMENTAL CRITERIA-BASED MODELS

PWA evaluated 5 soil erosion vulnerability models that primarily utilize environmental criteria in estimating the quantity or magnitude of soil erosion. These models include 3 spatial models: (1) Revised Universal Soil Loss Equation (RUSLE), (2) Watershed Erosion Prediction Project (WEPP), and (3) Cal Fire Erosion Hazard Rating (EHR). Because the spatial models listed evaluate hillslope conditions and do not account for road or trail alignment surface erosion, we also evaluated 2 linear soil erosion models (i.e. WEPPRoad and SEDMODL2) specifically aimed at estimating surface erosion of road and trail segments. The linear and spatial models can be used together to provide an overall qualitative evaluation of the magnitude from soil erosion off-site (hillslopes adjacent to roads and trails) and the magnitude of soil erosion on-site (road and trail surfaces). The outputs from these methods would be soil erosion vulnerability maps that delineate potentially sensitive hillslope areas and road/trail segments, and provide a guide for managers to use to evaluate the soil erosion sensitivity of the landscape when determining whether a proposed change in use is appropriate.

3.11 Spatial soil erosion vulnerability models

3.111 Revised Universal Soil Loss Equation (RUSLE)

The Revised Universal Soil Loss Equation (RUSLE) is a simple empirical model that predicts long-term average annual soil loss (tons/year) resulting from raindrop impact and slope runoff. The method was developed by the USDA Agricultural Research Service (ARS) and the USDA-Natural Resources Conservation Service (NRCS) for predicting soil loss on disturbed agricultural lands, but has been used extensively by others for conservation, mining, construction, and forestry uses (Renard et al., 1996). It is the accepted method for estimating soil loss for projects requiring a Construction General Permit in the state of California. Its predecessor, the Universal Soil Loss Equation (USLE) was initially developed in 1978 and then the method was further refined in 1997 as the RUSLE.

The RUSLE method calculates average sheet and rill soil erosion and assumes that factors of climatic erosivity, soil erodibility, topography, vegetative cover, and management practices control the rates of surface soil erosion.
The RUSLE equation is defined as:

$$\mathbf{A = R * K * LS * C * P}$$

A = Estimated average soil loss in tons/yr

R = Rainfall-runoff erosivity factor. This represents the annual erosional force of rainfall and is the sum product of the total kinetic energy (E) times the maximum 30-minute intensity of all major storms in an average year.

K = soil erodibility factor. This represents the soil erodibility based on specific soil properties. The main factors affecting K are soil texture, organic matter, structure, and permeability of soils.

LS = Slope length (L) and Slope steepness (S) factors. These factors together represent the effect of slope length, slope steepness, and slope shape on surface erosion. In general, longer and steeper slopes exhibit more surface erosion.

C = Cover/vegetation factor. In general, this factor represents effects of plants, soil cover, soil biomass, and soil disturbing activities on erosion.

P = Support practice cover factor. This factor represents the effects of management practices (i.e. timber management, tillage, slope contouring, cropping, erosion control practices).

In addition to its use in estimating annual soil erosion rates, the RUSLE method has been used for non-agricultural lands as a tool for evaluating soil erosion vulnerability. Blazczynski (2001) suggested that the RUSLE could be used as a tool to provide a "regional-level analysis" of soil erosion. The implication is that a qualitative RUSLE analysis can provide a "rapid reconnaissance level evaluation as to where we can expect low, medium, high, and very high erosion rates" (Blazczynski, 2001). For example, the state of Oregon utilized the RUSLE, using GIS applications, in developing a statewide soil erosion vulnerability tool to determine areas of potential soil erosion sensitivity at the basin-scale (Hickey et al., 2005). For purposes of the State Parks' PEIR, a RUSLE model output would consist of a qualitative map illustrating soil erosion vulnerability (High, Moderate, Low) based on the estimated annual soil loss rates for the proposed change-in-use project area.

The RUSLE has also been used extensively internationally to evaluate soil erosion vulnerability on both agricultural and non-agricultural lands (Lopez et al., 1998; Kouli et al., 2008; Bonilla et al., 2010). Finally, the RUSLE has been used to evaluate soil erosion from roads and trails. For example, Kuss and Morgan (1980) and Morgan and Kuss (1986) used the RUSLE method to assess the carrying capacity of trails, Hood et al. (2002) used the method to estimate soil erosion from trails, and Aust et al. (2005) used the RUSLE to evaluate whether gravel application on trails reduced surface soil erosion.

Although the RUSLE is a well tested and scientifically validated method, it has inherent limitations for assessing soil erosion vulnerability on undisturbed or non-agricultural lands. The main limitation of the RUSLE is that the method was primarily developed for agricultural and disturbed lands, and its equation is based on specific data related to croplands and disturbed slopes; for this reason, model results are inconsistent for non-agricultural land uses. Overall, engineering and soil scientists and agricultural-industry specialists agree that this method should not be used to determine annual soil loss estimates for non-agricultural uses. This is mainly due to poorly defined values of the cover/vegetative factor (C) and practices factor (P). Due to the simplicity of the RUSLE formula, incorrect values of C and P can result in significantly erroneous results.

Other limitations to the RUSLE method include: (1) the method does not account for spatial or temporal variation of erosion processes; (2) it cannot produce watershed scale sediment yields; (3) the method only estimates soil erosion from rill and inter rill (sheet and rill) erosion, and does not estimate erosion from channelized flow including gullies and streams; and (4) there are limits on hillslope lengths (between 35 ft - 600 ft for model accuracy; should not be used on slopes

>1000 ft) and hillslope gradients (3% - 35% for model accuracy; should not be used on hillslopes with gradients >50%).

This method is not suitable for use by State Parks staff in the evaluation of road and trail change-in-use projects. As stated in the limitations above, the RUSLE method was developed for non-agricultural lands, and as a result may provide inconsistent and inaccurate results in forested and undisturbed land settings. In addition, the model does not address user-defined impacts on erosion, but only focuses on the environmental factors that influence erosion. Although the tool can provide a general and qualitative spatial assessment of erosion hazard, it would not be a defensible method for the decision of whether or not to accept a road or trail change-in-use proposal.

3.112 Water Erosion Prediction Project – WEPP

The Water Erosion Prediction Project (WEPP) model was developed in 1995 by the National Soil Erosion Research Laboratory (NSERL) and the USDA ARS to evaluate inter rill and rill erosion from agricultural lands and forestry. Essentially, WEPP is a robust GIS-based model designed to replace the Universal Soil Loss Equation (USLE). WEPP is a process based, distributed parameter, continuous simulation, erosion prediction model that computes the rate of soil loss and sediment delivery from small watersheds (<640 acres) and short hillslope lengths (<300 m) on a daily, monthly, or annual basis. The model is able to simulate non-uniform slopes, soils cropping, and management conditions, and utilizes the fundamentals of stochastic weather generation, infiltration theory, hydrology, soil physics, hydraulics, and erosion mechanics (Flanagan et al., 1995).

The WEPP model is more mathematically rigorous than the RUSLE method, because it can estimate soil erosion both temporally and spatially; and it can estimate sediment delivery. The WEPP model is scientifically well tested and has a variety of interfaces to predict erosion from: (1) roads (WEPP Road), (2) rangeland and forest disturbances (Disturbed WEPP), and (3) fuel management practices (WEPP FuME). Because the WEPP model is GIS-based, it can provide quantitative and qualitative soil erosion vulnerability maps that can be used by managers to identify areas of potential soil erosion hazard.

Like all models, the WEPP model has inherent limitations. Similar to the RUSLE method, WEPP can only estimate inter-rill and rill erosion and cannot estimate erosion from channelized flow (e.g. gullies and stream channels). The WEPP model depends on numerous parameters (i.e. daily values of precipitation; temperature, solar radiation, wind information, slope length, slope steepness, profile aspect, plant parameters, tillage information, plant and residue management, contouring, subsurface drainage, crop rotations, and soil properties, including texture, erodibility, critical shear parameter, hydraulic conductivity, and porosity) to model the physical processes of erosion (ARS–USDA, 1995; Flanagan et al., 1995) and, therefore, it is much more complex than the RUSLE model. For that reason, RUSLE is more commonly used by government agencies, private businesses and individuals (e.g. for forestry, agricultural, and construction planning) because of its simple empirical equation. Finally, the WEPP has limits on scale of use. The model is developed to model “field-sized” areas (<640 acres) and shorter slopes (< 300 m). In larger watersheds and on longer hillslopes, soil loss estimates are inconsistent and not representative of these conditions.

The WEPP model is a rigorous mathematical model that requires a variety of complex physical parameters. For that reason, this model may not be appropriate for general use by State Parks staff. A method or model that assists with the decision of whether a road or trail change in use is appropriate should be straight forward and less complex for general use by State Parks staff. Similar to the RUSLE model, the WEPP model analyzes erosion spatially using only environmental factors and does not take into account trail user-defined factors. The product of the WEPP model for the State Parks PEIR would be a spatial representation of erosion hazard and would not provide a systematic framework for a decision regarding the appropriateness of a road or trail change-in-use project.

3.113 Cal Fire Erosion Hazard Rating – EHR

The Cal Fire Erosion Hazard Rating (EHR) method was developed in 1973 by soil scientists and foresters for measuring the relative sensitivity of forested sites, with a minimum area of 10 to 20 acres, to erosion from rain drop impact and surface runoff. The surface erosion hazard ratings are based on the following 6 erosion factors: slope, soil depth, soil texture, soil rock content, vegetative cover, and rainfall intensity (Rice and Sherbin, 1977). The EHR method was adopted in 1973 as part of the California Forest Practice Rules for the Coast Forest Practice District and later updated in 1990 as Technical Rule Addendum Number 1 (Cal Fire, 2011).

The erosion hazard ratings were initially based on regression analyses of slope, geology, soils, and climatic factors conducted by Anderson (1972, 1974). This subjective and simplistic method was initially untested in the field but adopted for use in 1974 as a requirement for the development of timber harvest plans (THPs) in the state of California. The Cal Fire EHR method was finally field tested by Datzman (1978) and Rice and Datzman (1981), but in both studies showed poor statistical performance. Although this method has been criticized by the scientific community, it continues to be used as a standard in the California Forest Practice Rules.

The EHR method involves a defined field methodology and a decision tool in the format of a checklist/score sheet. Each erosion factor is weighted based on importance (1) within the factor, and (2) between factors. An erosion hazard level is estimated for each factor and the erosion hazard level for each factor is then summed to determine the overall erosion hazard rating for the project location. The resulting erosion hazard rating dictates the type of land management practices that can be implemented (e.g. cable yarding or tractor yarding, clear cut harvest or selective harvest). The greatest limitation to the EHR method is its subjectivity and over simplicity. The method requires further field verification and statistically robust analysis. As a qualitative soil erosion vulnerability tool, EHR analysis can provide a project area map of soil erosion hazard (High, Moderate, Low).

The Cal Fire EHR method is a highly developed checklist and is not a model. This method incorporates environmental criteria and does not consider road or trail user-defined factors. As stated, this method would produce a qualitative spatial representation of soil erosion vulnerability. This method has been reviewed by state agency scientists and is used as a standard in the California Forest Practice Rules. This method would not be appropriate for the State Parks PEIR as it does not evaluate user-defined factors.

A very similar method by the same name "Erosion Hazard Rating" was developed by the California Soil Survey Committee (CSSC) and is used by the State Parks Off-Highway Motor Vehicle Recreation Division to evaluate soil erosion vulnerability. The method was also used to evaluate soil erosion for the EIR process (e.g. Kirkwood Meadows Power Line Reliability Project EIS/EIR). Similar to the Cal Fire EHR, this method does not take into account trail user-defined factors, and as a result we did not pursue the assessment of this method for evaluating soil erosion in the State Parks PEIR.

3.12 Linear soil erosion vulnerability models

3.121 Water Erosion Prediction Project Interface for Roads -WEPP Road

The WEPP: Road model is component of FS WEPP, a set of interfaces that calculate and evaluate average erosion and sediment delivery from forest roads (Elliot et al., 1999). WEPP: Road is a web-based interface to the WEPP model that allows the WEPP model to calculate erosion from the entire road prism, including sediment delivery through a forested buffer strip below the road fillslope. Specifically, the model predicts surface erosion and runoff from roads, and compacted linear surfaces including landings, skid trails, foot trails, cattle trails, and off road vehicle trails. The WEPP: Road model is based on the following parameters to calculate sediment production: monthly climate data, soil characteristics, road characteristics (e.g. road shape, length, width, gradient, surface type), and buffer characteristics.

The WEPP: Road model outputs include tabular summaries of the estimated soil loss from road surface erosion and sediment delivery for a defined time period (e.g. annual, 10 year, 30 year), and results from multiple runs on road or trail segments can be organized into a road log that can be used to evaluate surface erosion potential along a road or trail network. This road log can be routed in GIS to provide a map of the linear road/trail network illustrating the surface erosion potential (High. Moderate, Low) based on surface soil erosion rates generated from the WEPP: Road model.

The WEPP: Road model has topographic limitations including: (1) alignment gradients cannot exceed 40%; (2) alignment lengths cannot exceed 300 m; (3) fillslope and buffer lengths cannot exceed 100 m in length; and (4) fillslope and buffer gradients cannot exceed 100%. All other limitations, as explained in the discussion of the general WEPP model, also apply to the WEPP: Road interface (Elliot et al., 1999). Other limitations include: (1) model does not account for mass wasting failures, including slope or slump failures; (2) model has an inherent error of plus or minus 50% for high traffic roads (Elliot et al., 1999); (3) road and trail segments greater than 300 m need to be analyzed as shorter segments that may result in an under prediction of surface erosion and sediment delivery; and (4) the model is best used to compare different road designs (e.g. road upgrade or road decommission) or to predict impacts from road or trail management practices, and not as a exact numeric predictor of surface erosion from roads and trails (Breibart et al., 2007).

The WEPP road model was considered to complement the RUSLE and WEPP models. Because RUSLE and WEPP would produce qualitative spatial representations of soil erosion vulnerability on hillslopes adjacent to road and trail alignments, linear models such as WEPP road and SEDMODL2 were considered to qualitatively evaluate soil erosion sensitivity on the road or trail alignment. Both spatial and linear representations of soil erosion vulnerability can provide State Parks staff with an overall estimation of soil vulnerability for the area of a proposed road or trail change-in-use project. Similar to the 3 spatial models above, user-defined factors are not considered in the WEPP road model. Also, this method is limited with regards to road or trail length that can be analyzed. Multiple runs of the model would need to be conducted for roads or trails that are longer than 300 m. We do not suggest the use of the WEPP road model for the State Parks PEIR. Outputs from these erosion models only provide a qualitative representation of soil erosion vulnerability and do not provide all of the available information necessary to determine whether a proposed road or trail change in use is appropriate.

3.122 Sediment Model –SEDMODL2

SEDMODL2 is an empirical GIS-based model developed by the Boise Cascade Corporation and the National Council for Air and Stream Improvement, Inc. (NCASI, 2002, 2005) and is based on the surface erosion module of the Washington Department of Natural Resources Standard Method for Conducting Watershed Analysis (WDNR, 1997) and the WEPP model. SEDMODL2 was developed to estimate average annual surface erosion and sediment delivery from roads and to identify the portions of roads that have a high potential to deliver sediment directly and indirectly to streams. The model provides an average annual sediment input (tons/yr) from road reaches that deliver road runoff and fine sediment to streams by assuming road surface erosion is a function of geology, road surface condition, traffic level, surface area, road gradient and annual rainfall (Welsh, 2008).

The empirical relationships used in SEDMODL2 were developed from data sets from forested roads in Idaho, Oregon, Washington, northern California, North Carolina, and West Virginia. SEDMODL2 requires the following input variables: digital elevation model (DEM) based topography; spatial stream layer; spatial road layer that contains attributes for road width, surface type, traffic level, gradient, and width; monthly precipitation; surface erosion rate derived by the underlying geology; and soil characteristics (i.e. soil depth and bulk density). SEDMODL2 outputs include tabular summaries of estimated average road surface erosion and sediment delivery, and a modified spatial road network layer that contains attribute data for the estimated annual surface erosion and sediment delivery. The spatial road/trail network can be used to develop a map of road segments that are predicted to produce surface erosion and sediment delivery. Similar to WEPP: Road outputs, this spatial data can be analyzed to create a qualitative estimate of road/trail surface erosion vulnerability (High, Moderate, Low) and can be used with spatial models RUSLE, WEPP, or EHR to develop an overall qualitative tool for determining the location of areas potentially prone to surface erosion and sediment delivery.

Similar to all of the spatial models and WEPP: Road, SEDMODL2 only calculates surface erosion (inter-rill and rill erosion) and does not calculate channelized erosion (e.g. gullies and stream crossing erosion). Another limitation to the SEDMODL2 model is that it relies on spatial data for analysis, therefore if any of the spatial data (e.g. roads and streams) are inaccurately located or the DEM is low resolution or inaccurate, then predictions of surface erosion and sediment delivery will be inaccurate. As with WEPP: Road, SEDMODL2 is best used as a qualitative tool for predicting road segments that may be prone to surface erosion and sediment delivery and not for actual estimates of sediment production.

For the purpose of the soil erosion technical study, SEDMODL2, like the WEPP road model, is intended to complement spatial erosion models and methods, such as WEPP and RUSLE, and for the Cal Fire EHR method. As stated previously, we do not suggest the use of these erosion hazard models in the State Parks PEIR as a tool to determine the appropriateness of a road or trail change-in-use decision. These tools only evaluate environmental factors and do not consider road or trail user-defined factors.

3.2 ENVIRONMENTAL AND USER-TYPE CRITERIA-BASED DECISION METHODS

Environmental criteria-based models for predicting soil erosion vulnerability are useful as a qualitative tool for identifying areas of potential surface erosion hazard risk, but they cannot provide a decision as to whether a management action, or in the case of the State Parks' PEIR, a road and trail change-in-use proposal, is appropriate, because they do not account for all important factors predicting erosion. For instance, the environmental criteria-based models solely rely on environmental parameters and do not include parameters associated with road/trail user-type influences or current road and trail erosion issues. To determine the soil erosion vulnerability for a road and trail change-in-use proposal, it would be useful to incorporate both environmental and user-type criteria, based on field verified baseline conditions, in developing final decisions as to whether changes in use are supported by the existing conditions of the road or trail network.

Multi-criteria-based decision methods are an option for evaluating relevant variables (both environmental and road/trail-type uses) for effects of proposed road and trail change-in-use proposals on surface erosion. This method relies upon a rigorous and rational "decision analysis" framework. This framework allows for making complex decisions when intuitive logic and reasoning are not adequate to solve a problem. According to Maguire and Boiney (1994), utilizing a formal decision process provides a transparent and repeatable process with a common decision rule method, and presents the most optimal choice for complex problems. In addition, a well-designed decision tool incorporates a comprehensive risk analysis that assesses all of the available and, more importantly, relevant data that will provide useful information on existing baseline conditions and whether a management decision has favorable or unfavorable consequences (Sullivan, 2002).

Decision analysis involves the following sequential multi-step framework based on Drucker (2001): (1) defining and identifying the problem, (2) analyzing the problem by establishing and weighing decision criteria, (3) specifying the possible solutions or alternatives to the problem, (4) determining the best solution to the problem by evaluating pertinent information and conducting a risk analysis, (5) identifying management actions for each alternative, and (6) implement the decision and monitor for effectiveness (Figure 1).

Figure 1. The decision-making process.
From: http://www.flatworldknowledge.com/node/28915#web-28915

Many multi-criteria, decision-making methods begin with a decision matrix that systematically identifies, evaluates, and weights specific attributes/criteria, and prioritizes a list of options or alternatives. The decision matrix is used in conjunction with a selected mathematical decision-making method to determine the optimal solution. A simple example of a decision matrix is illustrated in Figure 2.

Criterion	Criterion rank	Weight	Alternative A	Alternative B	Alternative C
C_1					
C_2					
C_3					
C_i					
Total rating		--			
Summary					

Figure 2. Example of a simple decision matrix.

There are two types of multi-criteria, decision-making methods: non-compensatory and compensatory;, that are based on whether criteria are independent and have no relation to each other, or whether criteria may have offsetting effects relative to each other. This discussion will focus on the compensatory, multi-criteria, decision-making methods, because a multi-criteria decision analysis for the State Parks PEIR would involve criteria that are not independent and may have significant effects on each other.

The most commonly used compensatory multi-criteria decision models include the (1) Simple Additive Weighting (SAW), (2) Weighted Product Model (WPM), (3) Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), (4) Analytic Hierarchy Process (AHP), and (5) Elimination and Choice Expressing Reality (ELECTRE). The following discussion evaluates the 5 multi-criteria decision models.

3.21 Simple Additive Weighting (SAW)

The Simple Additive Weighting Method (SAW) or weighted linear combination is a straightforward and widely used decision-making method that employs a scoring technique to produce the best solution for a complex multi-criteria-based problem. The weighted average score for an alternative is computed by summing the products of the normalized weight of a specific criterion and the performance score of the alternative for that particular criterion. Alternatives are ranked based on their weighted sum and the highest score pertains to the preferred alternative.

The first step of the SAW method is to develop a decision matrix listing the weighted attributes or criteria and the possible alternatives or solutions. The weighting scale for criteria needs to be normalized to provide commensurability or homogeneity of scales. Once the decision matrix is populated then the performance score for each alternative is calculated for each criterion using the following equation:

$$A_i = \sum_{j=1}^{M} w_j * r_{ij} \text{ for } i = 1, 2, \ldots, \text{N}$$

Where,

A_i is the overall score of the ith alternative or solution

w_j is the normalized weight or importance of jth criterion

r_{ij} is the performance rating of the ith alternative for the jth criterion

M is the number of criteria

N is the number of alternatives

Performance scores by criteria (A_i) are summed to generate a final overall average performance score for each alternative and then ranked to estimate the best possible alternative.

3.22 Weighted Product Model (WPM)

The Weighted Product Model is a scoring method that is similar to the SAW method, although not as widely used. Instead of using addition to generate the overall performance score for possible alternatives, the WPM model uses a multiplicative equation. This method uses the same methodology for developing a decision matrix, but does not require the normalization of the weighted criteria values. Due to the structure of the WPM equation, units of scale for criteria are eliminated and become dimensionless.

The performance of each alternative is calculated by multiplying a series of ratios for each criterion. Each ratio is raised to the power of the specific criterion. Raising the ratios to a specified power eliminates the units of scale and makes the computation dimensionless. WPM uses the following equation (Triantaphyllou, 2000):

$$R\left(\frac{A_K}{A_L}\right) = \prod_{j=1}^{n}\left(\frac{a_{Kj}}{a_{Lj}}\right)^{w_j}$$

Where $R\left(\frac{A_K}{A_L}\right)$ is the performance score for the comparison of the 2 alternatives K and L

A_K is alternative K

A_L is alternative L

a_{Kj} is the performance score for alternative K for the j^{th} criteria

a_{Lj} is the performance score for alternative L for the j^{th} criteria

w_j is the weight or importance of the j^{th} criteria

n is the number of criteria

The preferred alternative is determined if the ratio $R\left(\frac{A_K}{A_L}\right)$ is greater than or equal to one.

3.23 Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) model was conceived in the 1980s by Kwangsun Yoon and Ching-Lai Hwang. The basic premise of the TOPSIS decision model is that a preferred alternative should have the shortest distance to the ideal alternative and be farthest from the negative-ideal alternative. The value of shortest distance or “relative closeness” is defined as an index derived by combining the distance from the positive-ideal alternative and the distance from the negative-ideal alternative (Yoon and Hwang, 1995).

The TOPSIS model utilizes a decision matrix that lists the normalized weighted criteria or attributes, and lists the performance score of each alternative based on each criterion, thereby identifying the ideal alternative and the negative-ideal alternative. Once the ideal and negative-ideal alternatives have been delineated, the distances of each criterion from the ideal alternative and from the negative-ideal alternative are calculated using the Euclidean distance norm (Li and Xie, 2006). The alternatives are then ranked based on their relative closeness to the ideal alternative. Ultimately, the smaller the distances to the ideal alternative and the greater the distances from the negative-ideal solution dictate the best alternative choice.

3.24 Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) model was developed in 1977 by Thomas Saaty and is based on 4 steps: (1) problem modeling, (2) weights valuation, (3) weights aggregation, and (4) sensitivity analysis (Ishizaka and Labib, 2009) The method involves an intuitive, systematic mathematical process for solving problems by hierarchically decomposing a problem down to smaller sub-problems, dependent criteria, and list of alternative choices (Figure 3). A pair wise comparison (eigenvalue-eigenvector analysis) of the alternatives is conducted for each of the criteria so that the relative importance of one criterion over another can be determined. This analysis creates a square matrix of judgments that relate to the (1) weights of importance of the criteria and (2) the relative performance measures of the alternatives (Triantaphyllou and Mann, 1995). The criteria weights and performance values for alternatives are then normalized and checked for consistency. The decision on the best alternative is based on the normalized performance score of the alternative choices.

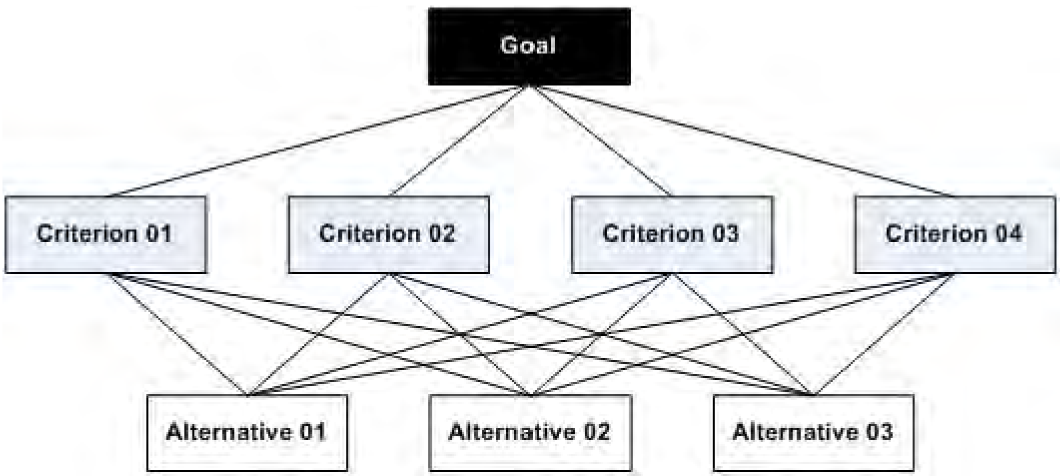


Figure 3. Analytic Hierarchy Process. From: http://www.ricardo-vargas.com/articles/analytic-hierarchy-process/

3.25 Elimination and Choice Expressing Reality (ELECTRE)

The Elimination and Choice Expressing Reality (ELECTRE) model was developed in Europe in 1966 by Bernard Roy and the SEMA consultancy company (Figueira et al., 2005). The decision-making method evaluates and ranks the performance of each alternative by a set of common criteria. The method was originally developed to construct a partial ranking system that allows the user to choose the best alternative. Other derivatives of this method were developed including: (1) ELECTRE II used to evaluate the full ranking of alternatives and (2) ELECTRE III that incorporates a method for outranking alternatives.

ELECTRE uses a decision matrix to develop and weight a set of criteria that are normalized to numeric scales with identical ranges. The next step involves the pair-wise comparison of alternatives based on calculated results of concordance and discordance indices. The concordance index allows the determination of whether one alternative is at least as good as another and the discordance index determines whether an alternative is not as good as another. These indices are then compared to two sets of concordance and discordance thresholds, one set for a strong outranking relationship and one set for a weak outranking relationship. The values of the concordance and discordance thresholds are determined by the decision makers. Once the alternatives are ranked in comparison to each other, they are ordered into two pre-orders of alternatives: (1) ascending from worst to best alternative and (2) descending from worst to best (Wang. and Triantaphyllou, 2006). These two sets of pre-order alternatives are then mathematically combined to create a final order of ranked alternatives that can be sorted to determine the best alternative.

3.26 Multi-criteria decision method limitations and suitability for the State Parks PEIR

The Simple Additive Method (SAW) is the most commonly used multi-criteria decision tool. The model uses a very simple mathematical structure that can be grasped by all users. The simplicity of the model lends itself to criticism due to a number of factors. First, the method depends on a subjective estimate for criteria weighting. This can introduce error, if decision makers are biased in the interpretation of criteria importance and sensitivity. The method also requires that the criteria ranking system be normalized or standardized to adjust for different measurement units for criteria. Although the problem of error associated with the normalization of criteria ranking and criteria weighting is also an issue with the TOPSIS, AHP, and ELECTRE models. The WPM model eliminates that problem associated with normalization, because its mathematical structure makes the criteria units dimensionless.

By far, the SAW method is the most appropriate multi-criteria decision tool for the State Parks PEIR. It is based on a simple additive formula and considers as many relevant criteria as are needed to make an informed decision on a road or trail change-in-use project. The method has limitations, as stated above, but it has been rigorously tested and validated by a variety of mathematicians, statisticians, and multi-criteria decision analysis theoreticians. This method requires a subjective determination of criteria weights and factor rankings, but these estimates will be made using information from available literature and scientific studies, consultations with subject-area experts in road and trail erosion processes, and with input and guidance from State Parks staff. The SAW method can provide a straightforward and defensible method for decision-making for road and trail change-in-use projects that have a variety of complex environmental conditions and user-defined issues.

The WPM method was not considered to be appropriate for the State Parks road and trail change-in-use process. Although this method is simple like the SAW method, it has not been as well used or validated as the SAW method. Although the WPM method benefits in a dimensionless analysis, a factor ranking system employed in the SAW method will provide standardized criteria values and allow a dimensionless analysis.

TOPSIS, AHP and ELECTRE are the most complex of the models reviewed. These models are based on complex mathematical relationships between criteria and alternatives, and as a result require more complex statistical computations and knowledge of their mathematical structure. Commercial software is available for both the ELECTRE and AHP models (e.g. “ELECTRE Pro” and “Expert Choice”), but the expense for the general user may be prohibitive. Also, both ELECTRE and AHP methods rely on pair wise comparisons of all alternatives to each criterion. If the problem is dependent on numerous criteria, then the mathematical process increases, as does the number of pair-wise decisions. Based on their complexity, these complex methods would not be appropriate for general use by State Parks staff in developing decisions on road or trail change-in-use projects,

4. STATE PARKS PEIR ROAD AND TRAIL CHANGE-IN-USE CONCEPTUAL DECISION-MAKING PROCESS

4.1 CONCEPTUAL ROAD AND TRAIL CHANGE-IN-USE DECISION-MAKING PROCESS

The decision-making process can be very difficult and frustrating when many related and unrelated issues or criteria influence the outcome of a final decision. Decisions are sometimes based upon emotional or biased judgments and do not involve the assessment of relevant and important information that would lead to rational and informed decisions. Using a structured process, such as a multi-criteria decision model, allows the decision maker to systematically evaluate relevant and related criteria that may have a significant effect on a decision option. A structured analysis allows the evaluation of the importance and effect of these criteria and prevents the decision maker from being distracted by information that may not be relevant or have a significant impact on the final decision.

A multi-criteria model approach to the State Parks Road and Trail Change-In-Use Evaluation Process would provide a systematic, straightforward, and repeatable method for evaluating erosional impacts from a proposed change in use of a road and trail system or segment. The challenge is to develop to a multi-criteria decision model that evaluates environmental and user-type criteria that have an effect on erosion of the road and trail system, determine the magnitude of effects that these criteria have on a road or trail proposed for a change in use, and determine whether the existing road or trail has the capacity to allow the change in use or whether the proposed change would cause significant erosional effects. The proposed method provides a baseline for existing road and trail conditions and guides the decision maker to develop an informed management decision that has the least significant erosional effects.

The proposed State Parks Road and Trail Change-In-Use Evaluation Process involves a series of steps to determine one of three alternatives: (1) a road and trail change-in-use proposal is appropriate for the existing conditions of the road or trail, (2) a road and trail change-in-use proposal is appropriate if best management practices (BMPs) are employed to mitigate significant erosional effects, or (3) a road and trail change-in-use proposal is not appropriate because implemented BMPs cannot reduce the significant erosional effects caused by the proposed change in use. The third alternative results in refusing the proposed change in use or conducting further EIR analysis.

Figure 4 describes the proposed SPEIR road and trail change-in-use multi-criteria, decision-making process. The process follows general decision-making theory where a problem is defined (whether to change the use of a road or trail); the possible alternatives are stated (see above alternatives); attributes or criteria that influence the alternatives are evaluated (risk analysis or existing conditions assessment); the standards of the attributes or criteria are specified; a mathematical decision-making model is applied; best management practices that will ensure the best alternative are identified; the best alternative is evaluated and selected; and the chosen alternative is implemented and monitored. This approach to decision making is similar to a strategy developed in 1985 by the U.S. Forest Service (Stankey et al., 1985). The Limits of Acceptable Change for Wilderness Planning is a method developed for land managers to determine whether recreational areas can tolerate increased recreational uses. The method uses field methods to evaluate the existing conditions of the resource areas and develops standards for the attributes or criteria that have an effect on the resource conditions. The information is then analyzed using a cost/benefits analysis (in terms of environmental and visitor impacts, and administrative costs) for each alternative. The best alternative exhibits the least impacts and acceptable costs.

PWA will develop the draft list of environmental and user-type criteria that will be ranked and weighted for the decision-making process. The criteria, and their rankings and weights, will be reviewed with State Parks staff prior to final development and population of the road and trail change-in-use decision model. PWA will also develop a spreadsheet for use in the State Parks PEIR that analyzes and calculates the best alternative using the Simple Additive Weighting (SAW) method. The steps to the SPEIR decision-making process (Figure 4) include:

Step 1. Define the problem – State the proposed change in use.

Step2. Conduct a risk analysis – Collect field-based and other available data on the environmental and user-type criteria that could have erosional impacts from the proposed road or trail change in use. This data should be collected when assessing the trail as part of the State Parks road and trail change-in-use process. For example, this data should be collected when conducting or updating the State Parks condition assessment log or when conducting the CGS watershed assessment for the area or trail in question. PWA conducted an extensive literature review of the criteria that can have significant effects on erosion of the road or trail system and based on our expertise developed a list of criteria that could have significant erosional effects from a road or trail change-in-use proposal (Table 1). A brief summary of these variables and their application and utility in the existing State Parks procedures (e.g. trail log and change-in-use survey form) is provided in Section 6 of this report.

Of the criteria listed in Table 1, the trail related, geomorphic, erosion feature type criteria will be assessed during the field inspection of the road or trail proposed for a change in use. These criteria should be incorporated into the trail log or CGS watershed tool data form. It would benefit the State Parks efficiency, and in administrative and staff costs, if these criteria were collected as part of trail assessments that are being conducted simultaneously. The remaining criteria, including meteorological, soil-related, and user-defined criteria can be collected as an office exercise. Annual precipitation and trail user information should be available through State Parks existing data. The soils data can be obtained from the USDA STATSGO2 (Web Soil Survey) data or, if available, from other soil studies conducted in the regional area. Although the soils data from the USDA Web Soil Survey may be general and at a gross scale in some areas, using a statewide database ensures systematic and consistent soil attribute information and dos not rely on a field call made by staff that may not have the needed soils expertise.

Table 1. Environmental and user-type attributes and criteria that affect erosion on roads and trails

Attribute	Attribute type	Criteria
Environmental	Meteorological	Annual precipitation
	Soils	Soil permeability
		Soil runoff
		Soil erosion hazard
		Shrink and swell potential
		Wind erodibility index
	Erosion features	Surface erosion
		Rills
		Gullies
		Landslides
	Road/Trail	Prism width
		Tread width
		Average trail grade
		Steepest trail grade
		Tread material type
		Tread material infiltration
		Wet, muddy areas
	Geomorphologic	Average hillslope gradient
		Slope shape
		Geomorphic position
User-defined		User-type
		Intensity
		Length of time of use
		Season of use

Road/Trail Conceptual Change-in-Use Decision Process

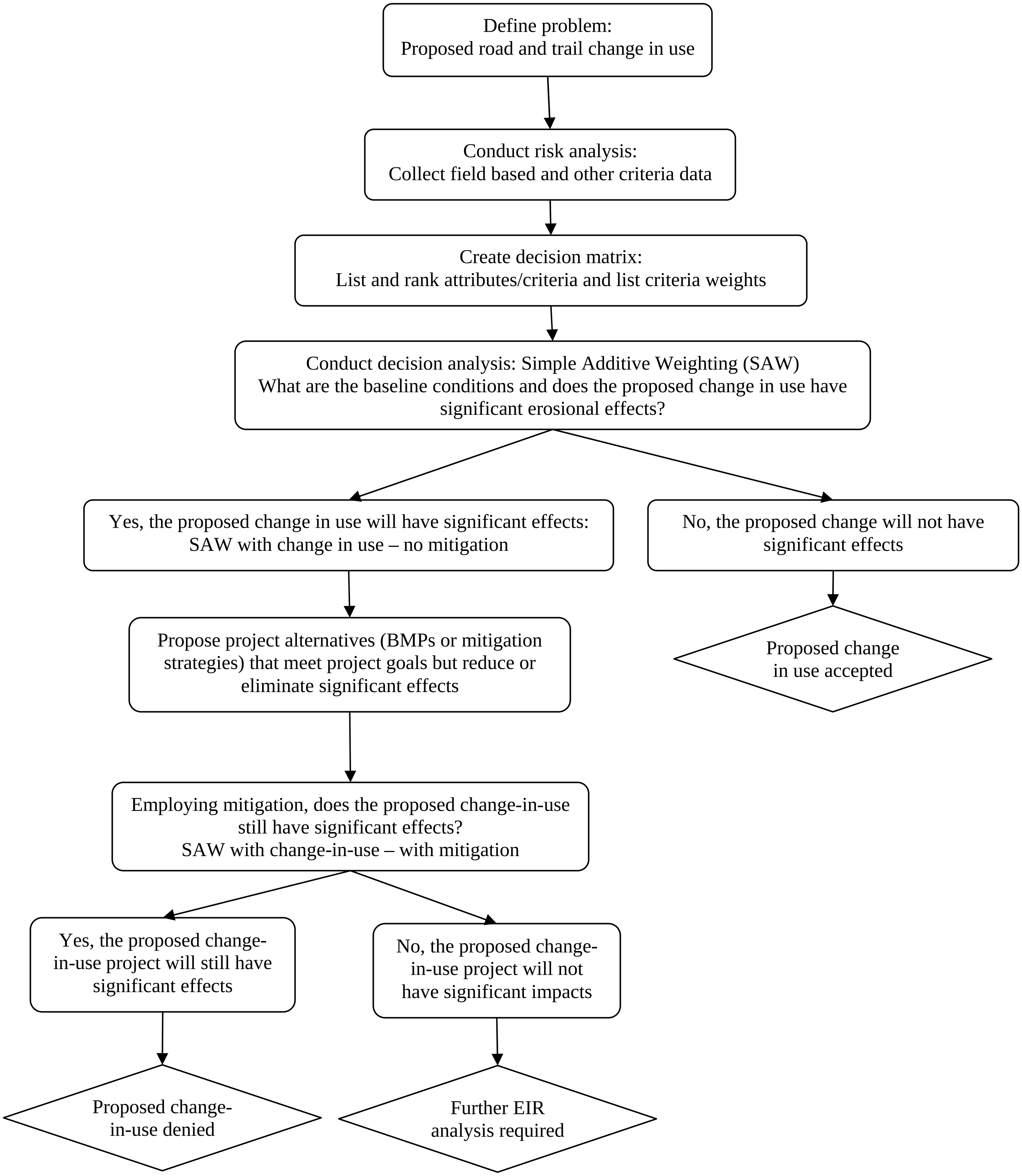


Figure 4. State Parks PEIR Road and Trail Change-In-Use conceptual decision-making process

The risk or performance ranking for each criterion will be based on a dimensionless scale of 1 to 5, with 1 being the highest risk of erosion and 5 being the lowest risk of erosion. The final list of criteria collected and the measurement protocol, as well as the criteria ranking will be developed for the next phase of the State Parks PEIR, with consultation and guidance from State Parks staff. Information collected as part of the risk analysis will be entered into a decision matrix as part of Step 3.

Step 3. Construct the decision matrix – As mentioned in Section 4, the decision matrix is a fundamental part to the multi-criteria decision analysis. A decision matrix is an L-shaped table listing the attributes and criteria in the rows: and criteria weights, criteria alternative performance rankings, and alternatives listed in the columns. Table 2 shows an example of the decision matrix for the State Parks PEIR road and trail change-in-use decision process. This decision matrix is the first step to conducting the Simple Additive Weighting (SAW) multi-criteria decision analysis to determine if a proposed road and trail change in use is a preferred alternative.

The decision matrix includes the inter-criteria weight and the intra-criteria performance rank. The inter-criteria weight is the relative weight of importance of a criterion relative to or amongst criteria. The inter-criteria weight will be calculated by PWA using a method of pair-wise comparison utilizing Saaty's nine point cardinal scale (Table 3). Criteria are compared to each other within a pair-wise decision matrix to determine which criterion is more important relative to the other. Each criterion weight is computed in the pair-wise decision matrix (n x n) and checked for consistency by determining the average random consistency ratio. The consistency ratio allows a check to make sure that the weights have been judged consistently. If the consistency ratio is not acceptable, then the comparison analysis will be reviewed and refined until the consistency ratio is an acceptable value.

The intra-criteria rank is the performance rating of each criterion dependent on the each alternative analyzed. As mentioned previously, PWA will provide a ranking system for each criterion based on a non-dimensional cardinal scale of 1 to 5, with 1 being the poorest performance (most significant erosional effect) and 5 being the best performance (no significant erosional effect). In Table 2 an intra-criteria rank is associated with each of the 3 alternatives: A, B, and C. The intra-criteria rank for "Alternative A: Existing conditions" refers to the ranking derived directly from the risk analysis: Step 2 and reflects the existing conditions of the road or trail proposed for a change in use.

"Alternative B: road and trail change in use, no mitigation" refers to a situation where a change in use is accepted, but no mitigation measures are implemented to control any erosion associated with the change in use or existing erosion problems. To develop the intra-criteria rank for Alternative B, the decision maker would change the intra-criterion rank that would reflect the change in use proposed. For example, if mountain bikers were added to the use of a hiker-only trail with no proposed mitigations, then the criterion performance rank for user-type would change to the appropriate rank for hikers and mountain bike usage combined.

"Alternative C: road and trail change in use, with mitigation" refers to a situation where a change in use is accepted and mitigation strategies are implemented to treat potential erosion resulting from the change in use and existing erosion problems identified during the risk analysis. To calculate the criterion performance ranks for Alternative C, the decision maker would adjust the criterion performance ranks to reflect change in use and any performance criterion rank changes associated with implemented mitigation measures. For example, if the trail change in use described previously incorporates mitigation measures that treat erosion impacts, then some of the criterion performance ranks for erosion features and trail characteristics would increase (decrease significant erosional impacts). Using this decision matrix and the Simple Additive Weighting (SAW) method allows the scoring of each alternative. Alternative scores will change based on the adjustment of the criterion performance rank in each scenario. It is important to note that criteria performance ranks for meteorological, soils, and geomorphic data will remain constants because these criteria depict the baseline natural environmental conditions and obviously cannot be adjusted through mitigation efforts. The application of the SAW method will be discussed in Step 4.

Step 4: Conduct decision analysis for Alternatives A, B, and C – The multi-criteria decision analysis will be conducted using the Simple Additive Weighting (SAW) method described in Section 4. The method requires the estimation of the best and worse performance scores for a road and trail change-in-use decision analysis. PWA will calculate the potential best and worst average weighted performance scores for the final road and trail change-in-use decision matrix used in the State Parks PEIR document. PWA will also provide State Parks with the decision matrix as an MS Excel spreadsheet that is designed to calculate the weighted performance scores for the 3 alternatives.

To calculate the best performance score, the criteria performance rankings will be set at a scale of 5 (the best performance or no significant erosion effects). The worst performance score will be obtained by setting all of the criteria performance rankings to 1 (the worst performance or extreme significant erosion effects). To develop the maximum and minimum scores, the SAW equation will be applied by summing the products of the criteria performance rankings and the criteria weights. By determining the maximum and minimum score for the SAW decision matrix, one can develop a frame of reference or the minimum score value that determines acceptability of the road and trail change in use. The minimal acceptable score that would permit a change in use will be mathematically calculated by PWA and provided as part of the final PEIR analysis.

To conduct the SAW analysis for a change-in-use proposal, the decision maker will populate the decision matrix by entering the appropriate alternative criteria performance rankings for Alternatives A, B, and C. As stated previously, Alternative A intra-criteria performance rankings are derived from the risk analysis and represent existing conditions, Alternative B analysis requires all criteria performance rankings used for Alternative A with exception to the change in use or use type. The use type criterion performance ranking should be changed to include all uses as a result of the proposed change in use. For example, if mountain bikes are added to a hikers-only trail, then the use type would be hikers/mountain bikes and the criteria performance ranking for that use type would be entered into the matrix. Alternative C criteria performance changes would include all criteria performance rankings delineated in Alternative B, except for criterion performance rankings that would change based on mitigation strategies.

Table 2. Example of State Parks PEIR decision matrix

Attributes		Criteria	Inter-Criteria standardized weight	Alternatives					
				A: Existing conditions: remains same		B: Change in use, no mitigation		C: Change in use, with mitigation	
				Intra-Criteria rank Alt. A	Score	Intra-Criteria rank Alt. B	Score	Intra-Criteria rank Alt. C	Score
Environmental	Meteorological	Annual precipitation							
	Soils	Soil permeability and runoff							
		USDA Web Soil Survey soil erodibility factor (K factor)							
		Shrink and swell potential							
		Wind erodibility index							
	Existing erosion features	Surface erosion							
		Rills							
		Gullies							
		Landslides							
	Trail	Trail width (ft)							
		Tread width (ft)							
		Average trail grade (%)							
		Steepest trail grade (%)							
		Tread material type							
		Tread material infiltration							
		Tread material erodibility							
		Wet, muddy areas							
	Geomorphologic	Average slope gradient (%) (perpendicular to trail tread)							
		Slope shape (planar, convergent, divergent, hummocky)							
User-defined	Use	Type of use							
		Intensity							
		Length of time of use							
		Season Use							
		Totals							

Table 3. Saaty's nine point scale for pair-wise importance[1]

Intensity of importance	Definition	Explanation
1	Equal importance	Indifferent - Two criteria contribute equally to the objective
2	Weak or slight	
3	Moderate	Slightly better - Experience and judgment slightly favor one criteria over another
4	Moderate plus	
5	Strong	Better - Experience and judgment strongly favor one criteria over another
6	Strong plus	
7	Very strong	Much better - A criteria is favored very strongly over another
8	Very, very strong	
9	Extreme	Most important - The evidence favoring one criteria is of the highest importance.

[1] Derived from Afshari et al. 2010

Decision makers must use professional judgment on the new criteria performance rankings developed, if mitigation strategies are implemented. The criteria weights do not have to be populated by the decision maker, because the weights will automatically be a component of the decision-matrix template. Once the criteria performance rankings have been populated, the criteria scores and final score for each alternative will be automatically calculated and provided at the bottom of the spreadsheet. Finally, determine the best alternative based on the final weighted score and compare with the minimum acceptable score for a road and trail change in use.

4.2 HYPOTHEICAL NUMERIC EXAMPLE OF THE STATE PARKS ROAD AND TRAIL CHANGE-IN-USE SAW DECISION ANALYSIS

To illustrate the use of the decision matrix and the multi-criteria analysis using the SAW method for the decision to change the use of a road or trail, a hypothetical example has been prepared with artificial criteria weights and criteria performance rankings (Table 4). This is only intended as an example and does not reflect the final criteria, weights and rankings that will be used in the final PEIR road and trail change-in-use decision analysis.

This hypothetical example shows the difference in alternative scores for a road or trail change-in-use proposal where mountain bike use is being added to a hiking only trail system. The highest weighted average performance score for a potential alternative is 5. This is based on the assumption that there are no significant erosional effects and all the criteria performance rankings are set at 5. The lowest weighted average performance score for a potential alternative is equal to 1. This assumes that all criteria are contributing to severe erosion and criteria performance rankings are set at 1.

The hypothetical trail in this example has erodible soils, steep trail grade, exhibits erosion problems, and is in an area with relatively high annual precipitation. To calculate the total performance score for Alternative A, the intra-criteria rankings are entered from the risk analysis. To reiterate, Alternative A represents baseline conditions. The total score for Alternative A is 2.46, which is slightly more than 50% of the optimal performance score of 5 (Table 4). To calculate "Alternative B: proposed change in use – no mitigation", all of the criteria performance rankings are the same as in Alternative A except for the criteria performance ranking for use type. Because mountain bikes are being added to the use type, the criteria performance rank for use type must change to the value for hiking and mountain biking combined. A combined hiking and mountain biking use type has a lower criteria performance ranking compared to hiking-only use-type. As a result the total average weighted score for Alternative B (2.28) is lower than Alternative A (existing conditions). Alternative B is nearly 55% lower than the optimal performance score of 5. In addition, the score for Alternative B is approximately 7% lower than the total performance score for Alternative A. Based on these results, the trail does not support the added use based on existing conditions and will experience further significant impacts from erosion.

The next step involves: (1) determining the mitigation strategies that can treat existing and expected erosion problems, (2) incorporating these mitigations into the decision matrix, and (3) calculating the total average weighted score for "Alternative C: proposed change in use – with mitigation". For the hypothetical example, it was assumed that mitigation strategies could be employed to reduce or eliminate significant erosional impacts, including: (1) treating existing and potential erosion problems, (2) modifying the trail tread width to reduce the area of bare soil that is prone to erosion, (3) apply gravel or other surfacing to the trail tread, and (4) install drainage structures at springs or stream crossings to reduce or eliminate trail runoff and muddy areas. For Alternative C, the intra-criteria performance rankings were adjusted to accommodate these mitigation measures. The total weighted performance score for Alternative C is equal to 3.10. This value is 38% lower than the optimal performance score of 5, although it only increased the performance level 12% above the baseline conditions (2.46). Although the performance score of "Alternative C: proposed change in use – with mitigation" increased, it did not change significantly. The score for Alternative C is only 3% higher than the median of the possible performance score of 3 (median of the lowest: 1 to highest: 5). Depending upon the minimum score that dictates whether a change in use is appropriate, a performance score of 3.1 may not be enough to warrant the change in use or may require a more detailed environmental study.

Table 4. Hypothetical numeric example of State Parks PEIR decision matrix

Attributes		Criteria	Inter-Criteria standardized weight	Alternatives					
				A: Existing conditions: remains same		B: Change in use, no mitigation		C: Change in use, with mitigation	
				Intra-Criteria rank Alt. A	Score	Intra-Criteria rank Alt. B	Score	Intra-Criteria rank Alt. C	Score
Environmental	**Meteorological**	Annual precipitation	0.09	2	0.18	2	0.18	2	0.18
	Soils	Soil permeability and runoff	0.07	3	0.21	3	0.21	3	0.21
		Soil erosion hazard	0.09	2	0.18	2	0.18	2	0.18
		Shrink and swell potential	0.05	2	0.1	2	0.1	2	0.1
		Wind erodibility index	0.01	5	0.05	5	0.05	5	0.05
	Existing erosion features	Surface erosion	0.05	2	0.1	2	0.1	4	0.2
		Rills	0.05	2	0.1	2	0.1	5	0.25
		Gullies	0.05	2	0.1	2	0.1	5	0.25
		Landslides	0.05	3	0.15	3	0.15	5	0.25
	Trail	Trail width (ft)	0.02	3	0.06	3	0.06	3	0.06
		Tread width (ft)	0.03	3	0.09	3	0.09	5	0.15
		Average trail grade (%)	0.03	2	0.06	2	0.06	2	0.06
		Steepest trail grade (%)	0.04	1	0.04	1	0.04	1	0.04
		Tread material type	0.02	2	0.04	2	0.04	4	0.08
		Tread material infiltration	0.02	2	0.04	2	0.04	4	0.08
		Tread material erodibility	0.02	1	0.02	1	0.02	4	0.08
		Wet, muddy areas	0.04	1	0.04	1	0.04	4	0.16
	Geomorphologic	Average slope gradient (%)	0.03	3	0.09	3	0.09	3	0.09
		Slope shape	0.02	3	0.06	3	0.06	3	0.06
User-defined	**Use**	Type of use	0.09	4	0.36	2	0.18	2	0.18
		Intensity	0.06	3	0.18	3	0.18	3	0.18
		Length of time of use	0.03	3	0.09	3	0.09	3	0.09
		Season Use	0.04	3	0.12	3	0.12	3	0.12
		Totals	**1.00**	**--**	**2.46**		**2.28**	**--**	**3.10**

4.3 CONSISTENCY AND TRANSPARENCY OF THE CONCEPTUAL DECISION-ASSISTANCE TOOL WITH STATE PARKS EXISTING ROAD AND TRAIL CHANGE-IN-USE PROCEDURES

The intent of the State Parks Road and Trail Change-In-Use Evaluation Process decision-assistance tool is to help decision makers make informed decisions about changes in use on roads and trails related to erosion vulnerability. The decision-assistance tool is intended to work in conjunction with existing State Parks trail assessment procedures such as the State Parks Trail Log and the Trail Use Change Survey, and the Watershed Assessment Tool (being developed for State Parks by the California Geological Survey). A State Parks Trail Log is required when a road or trail change in use is requested and involves the systematic collection of data pertaining to existing and potential erosion problems, trail sustainability issues, and allows for the prescription of mitigation measures to treat trail alignment problems. It uses census and sampling procedures, whereby a qualified staff person uses a distance measuring wheel and collects the location (distance) on the alignment where erosion problems occur and where mitigation measures will be implemented. The Trail Log also collects detailed information on the trail characteristics and erosion problems. The CGS Watershed Assessment Tool was developed for State Parks to inventory the State Parks road and trail system in a natural resource context for sources of erosion and to develop prioritized treatments with the goal of minimizing the impacts of erosion and runoff from poorly designed roads and trails.

The conceptual decision tool requires specific criteria that are to be used to evaluate existing conditions and determine whether a road or trail change in use is appropriate. This decision framework criteria data are either currently collected as part of the Trail Log or the CGS Watershed Assessment tool or need to be incorporated into one of these inventory procedures. The criteria data requirements for the decision-assistance should not require an additional assessment of the trail system. It is important to provide a usable decision tool that is efficient and does not require significant additional staff and administrative costs.

PWA will meet with State Parks staff and review the existing procedures to see which State Parks data collection effort (e.g. Trail Log, CGS, etc.) should incorporate the additional data assessment requirements in the context of the timing of road and trail change-in-use proposals. It seems appropriate that the additional data should be collected during the Trail Log assessment, because a Trail Log is required in response to a road or trail change-in-use proposal. The CGS Watershed Assessment is a single assessment of roads and trails that is currently being conducted on State Parks lands. Because road and trail change-in-use proposals occur sporadically and in a variety of State Park units, the CGS watershed assessment may not reflect the current conditions of the road or trail proposed for a change in use. Even though the CGS watershed assessment was conducted on a road or trail proposed for a change in use, a Trail Log would have to be completed, as required by the current State Parks Road and Trail Change-in-Use Evaluation Process procedures.

A State Parks Trail Use Change Survey is also required for each road or trail change-in-use proposals. The Trail Use Change survey evaluates the road and trail proposed for a change in use in the context of CEQA and trail user needs and expectations. The survey form includes general questions regarding existing conditions; compatibility for multi-use trails; and effects on trail user circulation patterns, trail use safety, trail sustainability, natural and cultural resources, and facility maintenance and operational costs. Currently, State Parks staff use the information collected in the Trail Log to answer the questions related to erosion risk and trail erodibility. The Trail Use Change Survey Form, by itself, does not result in a rigorous analysis that can provide a definitive decision on whether a road or trail can support a change in use. Although the survey form includes numeric data on the number of trail drainage structures, linear feet of rutting and rilling; the form also includes questions requiring subjective judgment, such as “Is the tread firm and stable?” or “Is the fillslope stable?” These general questions are qualitative and can lead to biased and subjective assessment of the road or trail existing conditions. The additional criteria data required by the conceptual decision-assistance tool provides quantitative data that can be used to develop rational and informed answers to the general survey questions in a systematic and repeatable manner.

5. CONCLUSIONS

Soil erosion from road and trail networks results from a variety of factors including environmental, management-related, and different trail uses (e.g. hikers, horses, mountain bikes, etc.). Making decisions about changing the use of a road or trail can be a difficult task because of the variety of factors and the magnitude of their effects on soil erosion. Many management decisions are made using subjective and potentially biased judgments based on observational interpretation or intuition and not upon available technical information and sound science. Erosion models and assessment methods may focus on a few environmental factors contributing to erosion (e.g. soils or precipitation), but ignore other significant management or user-defined factors that may have equal or larger effects on soil erosion. Complex decisions involving multiple criteria require a systematic approach to evaluating all factors that can contribute to negative environmental effects (e.g. soil erosion).

A multi-criteria decision-assistance tool, such as the Simple Additive Weighting (SAW) method offers a powerful tool for State Parks decision makers when determining whether roads or trails can accommodate changes in use. This simple and straightforward decision-making method weighs the importance of environmental, management-related, and user-defined criteria; evaluates the existing conditions; and tests the baseline conditions to see if a proposed change in use will have a negative effect on soil erosion. A decision-assistance tool provides State Parks with a defensible, transparent, and repeatable method that can be used statewide on all park lands. Although, a decision-assistance tool still requires subjective determinations of the performance ranking system and importance weights for environmental, management-related, and user-defined criteria, the increasing abundance of relevant scientific studies and literature and the expertise and experience of professional trails experts in the State Parks trails program will combine to provide a solid basis for the determination of relevant criteria and weightings to be employed when implementation of the decision-assistance tool. The values and output provided by this tool utilize logical and systematic methods in a transparent process to provide information that will assist park managers in arriving at sound resource management and visitor access decisions for their park.

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