MILL CREEK PROPERTY

Interim Management Recommendations

Prepared by:

Stillwater Sciences

Prepared for:

Save-the-Redwoods League

Coastal Conservancy

Mill Creek Property
Interim Management Recommendations

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San Francisco, California

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LIST OF ABBREVIATIONS AND ACRONYMS

BLM	Bureau of Land Management
BRT	Biological Review Team
CAIFMEG	California Interagency Fuel Mapping Group
CALVEG	California Vegetation Polygon Coverage
CCC	California Conservation Corps
CDF	California Department of Forestry
CDFG	California Department of Fish and Game
CEG	Certified engineering geologist
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFPR	California Forest Practice Rules
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CRYPTOS	Cooperative Redwood Yield Timber Output Simulator
CWA	Clean Water Act
CWAP	California Watershed Assessment Program
CWHR	California Wildlife Habitat Relationships
dbh	Diameter at breast height
DO	Dissolved oxygen
DOQ	Digital orthophoto quads
DPR	Department of Parks and Recreation
DTM	Digital terrain model
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPIC	Environmental Protection Information Center
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FMC	Fisheries Management Council
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
HCP	Habitat Conservation Plan
IMR	Interim Management Recommendations
ITP	Incidental Take Permit
LWD	Large woody debris
MIRA	Module of Individual for Roads Analysis
MOU	Memorandum of Understanding
MWAT	Maximum Weekly Average Temperature
NCRWQCB	North Coast Regional Water Quality Control Board
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPPA	California Native Plant Protection Act

NPS	National Park Service
NRA	National Recreational Area
PCFWWRA	Pacific Coast Fish, Wildlife, and Wetlands Restoration Association
PCT	Pre-commercial thinning
POC	Port Orford cedar
PWA	Pacific Watershed Associates
RMZ	Riparian Management Zone
SCC	State Coastal Conservancy
SCR	Scientific Collecting Permit
RNSP	Redwood National and State Parks
SDR	Salmon Disaster Relief Program
SHALSTAB	Shallow Landslide Stability Model
SRLRMP	Six Rivers Land and Resource Management Plan
Simpson	Simpson Timber Company
SRNRA	Smith River National Recreation Area
SOD	Sudden Oak Death
SONC	Southern Oregon/Northern California coast ESU
SRAC	Smith River Advisory Council
SRL	Save-the-Redwoods-League
Stimson	Stimson Lumber Company
THP	Timber Harvest Plan
USFWS	United States Fish and Wildlife Service
VDT	Variable density thinning
YOY	Young-of-the-year
WCB	Wildlife Conservation Board
WLPZ	Watercourse and Lake Protection Zone

Preface

by Save-the Redwoods League

June 4, 2002 marked the beginning of a new era for the Mill Creek property. Acquisition of the property by the state of California on this day provided complete watershed protection for the existing Jedediah Smith Redwoods State Park, while creating habitat linkages between Redwood National and State Parks and the inland forests of the Klamath-Siskiyou bioregion. Securing protection of the Mill Creek watershed has been a key League objective for more than 70 years. This vision has finally been realized through collaboration with League members, numerous conservation partners, and federal, state, and local agencies. The Mill Creek property will be managed under State Park ownership to protect and enhance fish and wildlife habitat and provide opportunities for compatible public access, research, and education. The California Department of Parks and Recreation will manage the Mill Creek property in consultation with an Advisory Committee that will monitor and review restoration and recreation priorities. The Committee will draw on expertise from the many resource professionals and scientific experts who were engaged in developing interim management recommendations for the property. These recommendations focus on near-term actions necessary to protect and enhance natural resources while allowing compatible public use.

After more than 50 years of industrial timber management, the average tree on the Mill Creek property is measured in decades. As of June 4, 2002, the focus for the property shifts to forest restoration in perpetuity. Due to its size and strategic location, the property presents an excellent opportunity to develop and test forest restoration techniques. Careful management can be used to accelerate development of late-successional characteristics in the young, homogeneous forests on the property. Educational opportunities on the property include scientific monitoring and research to ensure that these and other restoration goals are met. In addition, student environmental and service-learning programs are being developed through the Del Norte County Unified School District to expand students' understanding of the natural environment and to teach forest restoration and management skills. Mill Creek offers excellent opportunities for a wide range of compatible recreational uses that can bring people into close contact with north coast forests.

The newly acquired Mill Creek property challenges us to think on a broad time scale. These young forests may require hundreds of years to achieve the characteristics of old-growth forests. Those involved in the project will not live to see thousand-year-old redwood monarchs that will someday again grow along Mill Creek, but the purchase of the Mill Creek property is the beginning of an era of promise that will be realized through our continued engagement.

Katherine Anderton
Executive Director
Save-the-Redwoods League

The purchase and protection of the Mill Creek property and the development of these management recommendations represents the work of countless individuals over many decades. In particular, we thank those individuals who recognized the importance of the Mill Creek property and have dedicated their work to its forest, fish, and wildlife: the cooperation of Stimson Lumber Company, the technical assistance of Stillwater Sciences, and the key roll of sister conservation organizations - particularly those dedicated to California's wild salmon.

With special thanks to:
Wesley Chesbro, Ruth Coleman, Bob Hight, Mary Nichols,
Sam Schuchat, Byron Sher, Virginia Strom-Martin, Al Wright

EXECUTIVE SUMMARY

Introduction

The Mill Creek property is a 103 km^2 (40 mi^2) area located approximately 10 km (6 mi) southeast of Crescent City in Del Norte County, California. The property is bordered by Jedediah Smith Redwoods State Park to the north, Del Norte Coast Redwoods State Park to the west, Six Rivers National Forest to the east, and private industrial timber lands to the south. The property primarily encompasses the Mill Creek and Rock Creek watersheds - tributary to the Wild and Scenic Smith River. The property has a long history of timber harvest dating back to the 1850s. Between 1954 and 2000, the property was intensively managed for commercial timber harvest that included constructing an extensive road network and converting most of the property from old-growth to early-successional coniferous forest. Approximately 49 ha (121 ac) of old-growth forest remain in five separate stands. The State of California purchased the Mill Creek property from Stimson Lumber Company (Stimson) in June 2002, at which time, the entire property became a California State Park under stewardship of the California Department of Parks and Recreation (DPR).

Purpose and Objectives

The Mill Creek property was acquired by the State of California to (1) protect and restore the property's ecological values, (2) enhance regional ecological values by improving habitat connectivity between state and federal conservation areas, and (3) provide opportunities for compatible public use. Interim Management Recommendations (IMR) were developed to guide protection, restoration, and public use of the Mill Creek property until DPR adopts a General Plan for the property. The IMR planning process involved initial scoping meetings with resource agencies, focused working groups, and the public to define important interim management issues related to the Mill Creek property. Working groups were subsequently formed to define desired future conditions and identify management alternatives for the following priority issues: (1) road management, (2) second-growth vegetation management, (3) aquatic and terrestrial habitat protection, and (4) public use. Management recommendations were developed for each priority issue based on spatial analysis of potential risks and benefits to resources during the interim period.

Existing Conditions

The Mill Creek property is located in the western portion of the California Coast Range Province. The property encompasses portions of five watersheds draining steep, mountainous terrain with elevations ranging from 61 m (200 ft) to 732 m (2,400 ft). Small tributaries occupy narrow, deeply incised canyons with bedrock floors and little floodplain development, while the larger mainstem channels in the Mill Creek basin occupy broad, flat valley bottoms. Rock Creek flows through a narrow valley for most of its length. Bedrock geology is predominately sandstone, shale, and conglomerate in the Mill Creek area west of the northwest trending South Fork fault, and highly sheared serpentinite and peridotite in the Rock Creek area east of the South Fork fault. Erosion and mass wasting processes on the property are primarily associated with steep inner gorge slopes, hillslope hollows, and deep-seated landslides. The draft Habitat Conservation Plan for the Mill Creek property concluded that (1) streamside landslides from inner gorge landforms were a major source of sediment that increased in frequency due to timber harvest, (2) altered drainage pathways associated with roads were a major cause of instability, and (3) road-related erosion

represented the largest and most preventable source of sediment (Stimson Lumber Company 1998). Systematic inventories of roads and adjacent hillslope conditions in the Mill Creek and Rock Creek watersheds indicated that most future erosion and sediment yield was likely to come from three primary sources: (1) failure of road and landing sidecast fill, (2) erosion at or associated with stream crossings, and (3) road surface and ditch erosion (PWA 1996, 1997, 1998).

At least 15 vegetation series are present on the Mill Creek property (SHN 2000). Vascular plant species diversity is high with possibly over 300 species present. The coastal fog belt provides ideal conditions for fast-growing conifers such as coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and Port Orford cedar (*Chamaecyparis lawsoniana*). As a result of past timber management, forests on the property are predominantly comprised of even-aged, monospecific stands of various ages. Approximately 69% of the property supports stands of pole size or smaller trees (average dbh <28 cm [11 in]), while stands averaging >61 cm (24 in) dbh make up roughly 6%. Several rare, endangered, and special interest plant species are found on the property.

Streams within and downstream of the Mill Creek property support both anadromous and resident salmonid populations, including coho salmon (*Oncorhynchus kisutch*), fall chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), steelhead (*O. mykiss irideus*), and coastal cutthroat trout (*O. clarki clarki)*. Coho salmon are currently the only federally listed fish species found on the property. Several federally threatened or endangered terrestrial species occur in the area, including bald eagle, marbled murrelet, and northern spotted owl.

Analysis and Interim Management Recommendations

Management recommendations were developed for each priority issue based on spatial analysis of potential hazards, risks, and benefits to resources during the interim period. Analyses focused on identifying resource protection and enhancement opportunities consistent with (1) the goals and objectives of the acquisition; (2) input from the working groups, public, and advisory council; and (3) the longer-term planning objectives of DPR.

Road Management

Road use and maintenance affects all aspects of property management including public use, habitat protection and enhancement, fuels and fire hazard reduction, second-growth vegetation management, and research and monitoring. The Mill Creek property has a high density of predominantly insloped roads traversing steep terrain that experiences seasonally high rainfall. These combined factors necessitate intensive maintenance of road drainage features to avoid storm damage and associated delivery of sediment to the stream channel network. Interim road management practices were identified by conducting risk assessments at landscape and site-specific scales. At the landscape scale, erosion risk was assigned to areas based on the cumulative score from several hazard indicators. At the site-specific scale, The risk of road-stream crossing and log landing failure was prioritized based on existing inventory data. Estimates of risk at these two scales served as the basis for recommended road treatments, maintenance, and use during the interim period.

Rock Creek is a high priority subwatershed for road management based on a very high density of roads with large numbers of high risk road-stream crossings and large, potentially unstable log landings located on potentially unstable slopes. Rock Creek also experienced rapid rates of timber harvest during the 1990's, which may have preconditioned slopes to increased instability in the event of a future large storm event. The potential ecological impacts of storm erosion may be more severe in adjacent Mill Creek

subbasins with lower erosion risk but higher coho habitat value, closer proximity to old-growth forest stands, and greater opportunity for interim public use. Several priority areas are identified in the East Fork Mill Creek, West Branch Mill Creek, and Bummer Lake Creek basins.

Interim recommendations for road management:

- *Develop a long-term road management plan.*
- *Regulate road use.*
- *Develop an inspection and maintenance schedule.*
- *Inventory and establish treatment priorities for existing roads and log landings.*
- *Upgrade and stormproof roads with high erosion risk.*
- *Inspect and upgrade primary public access roads to State Park destination points.*
- *Decommission non-essential roads and treat associated hillslope erosion.*
- *Limit access to areas affected by plant pathogens.*

Vegetation Management

More than a century of industrial timber management on the Mill Creek property has resulted in a landscape dominated by even-aged, early-successional conifer plantations that lack structural complexity and biological diversity. The goals and desired future conditions under DPR management are to restore the complexity, diversity, and ecological values of late-successional forests. DPR can implement thinning of young stands as a management tool to accelerate restoration of late-successional characteristics, or it can allow these stands to develop late-successional characteristics through natural processes over a much longer timeframe. Priorities for vegetation management during the interim period were established by identifying young second-growth forests where forest restoration would provide the greatest potential ecological benefits and would most effectively reduce catastrophic wildfire risk. The spatial distribution and coincidence of indicators across the property were analyzed using a matrix approach similar to the risk assessment for road management. Very high priority areas are broadly distributed across the property and are predominately comprised of unthinned 11 to 20 year-old stands that (1) optimize connectivity and lie within existing old-growth habitat buffers, or (2) occur within fire management buffers in upper basin positions with a high risk of natural ignition.

Interim recommendations for vegetation management:

- *Develop a long-term forest restoration plan that identifies sites and silvicultural prescriptions to achieve desired future conditions in young second-growth conifer plantations.*
- *Develop a hypothesis-driven research framework to direct forest restoration, monitoring, and adaptive management.*
- *Develop a long-term fuels and wildfire management plan that identifies equipment, staffing, defensible space, fire watch and firefighting procedures, procedures for seasonal closure, and a program to reduce fuels and fire hazard in second-growth forests.*
- *Conduct field surveys to (1) verify the results of the vegetation analyses, (2) document stand conditions in high-priority areas, (3) identify rare or endangered plants, and (4) determine slope stability prior to implementing site-specific forest restoration or fuels reduction projects.*
- *Conduct variable density thinning of young second-growth conifer stands to decrease stem density; open the canopy; increase tree growth; encourage growth of understory vegetation; reduce surface, crown, and ladder fuels; and accelerate development of a structurally and biologically diverse forest.*
- *Establish appropriate shaded fuel breaks in high-risk areas, around public use areas, along high-use roads, and adjacent to neighboring commercial timberlands.*
- *Map the distribution of plant pathogens and potential host vegetation.*
- *Control the spread of plant pathogens.*

Aquatic and Terrestrial Habitat Management Areas

Protecting important fish and wildlife habitats and identifying areas most suitable for habitat restoration are high priorities for interim management of the Mill Creek property. We identified existing habitat suitable for species of concern and delineated management zones around these habitats. These management zones provide an overlay for identifying (1) limitations on the timing of public use and implementation of management programs, and (2) early-successional habitats where forest restoration would provide optimal short-term cost-benefit due to its proximity to existing high value habitat

Interim recommendations for aquatic and terrestrial habitat management:

- *Establish management areas to protect, enhance, and restore aquatic and terrestrial habitats.*
- *Implement measures to protect and enhance marbled murrelets, northern spotted owls, and their habitat.*
- *Implement measures to protect and enhance riparian and aquatic habitat.*
- *Establish management areas around unique and sensitive plant communities, including old-growth forest stands.*
- *Develop and implement a comprehensive watershed monitoring strategy to gather baseline data and monitor the effectiveness of protection measures and restoration activities over time.*

Public Access and Use

The Mill Creek property offers many opportunities for non-consumptive public recreational use consistent with the goals of restoring the ecological functions of late-successional forests. The objectives of the interim management plan are to identify suitable areas for initial public access based on (1) existing infrastructure; (2) road, forest, and fish and wildlife analyses; and (3) coordination with the DPR, resource agencies, and public. Recreational opportunities during the interim period include day-use activities (e.g., hiking, biking, fishing, and horse riding) that utilize existing facilities and the existing road network. Several regional trails on adjacent public lands could be connected to the property during the interim period using the existing road network. Additional near-term outreach, education, and research opportunities could be realized using existing buildings at the old mill site. Constraints to public access in the interim include fish and wildlife habitat protection, road management, and containment of forest pathogens.

Interim recommendations for public access and use:

- *Develop a long-term recreation management plan.*
- *Develop headquarter facilities at the old mill site through adaptive re-use of existing facilities.*
- *Evaluate the feasibility for establishing day-use facilities at the existing picnic area.*
- *Determine appropriate levels and areas of public vehicular road access.*
- *Establish a trail network.*
- *Implement fire hazard measures.*
- *Promote educational, research, and service-learning opportunities.*
- *Conduct a visitor carrying capacity analysis to determine appropriate levels of visitor access and use.*

Chapter 1

Introduction

1 INTRODUCTION

1.1 Background

The Mill Creek property is a 103 km^2 (40 mi^2) area located approximately 10 km (6 mi) southeast of Crescent City in Del Norte County, California. The property directly links large areas of old-growth coast redwood forest in Redwood National and State Parks with National Forests located in the western Klamath-Siskiyou Mountains. The property is bordered by Jedediah Smith Redwoods State Park to the north, Del Norte Coast Redwoods State Park to the west, Six Rivers National Forest to the east, and private industrial timber lands to the south (Figure 1-1). The property encompasses a large portion of the Mill Creek watershed (60 km^2 [23 mi^2]) tributary to the Wild and Scenic Smith River, a large portion of the Rock Creek watershed (31 km^2, 12 mi^2) tributary to the Wild and Scenic South Fork Smith River, and small headwater portions of the Terwar (2.6 km^2, 1.0 mi^2), Hunter (1.1 km^2, 0.4 mi^2), and Wilson (5.3 km^2, 2.0 mi^2) creek watersheds (Figures 1-2 and 1-3).

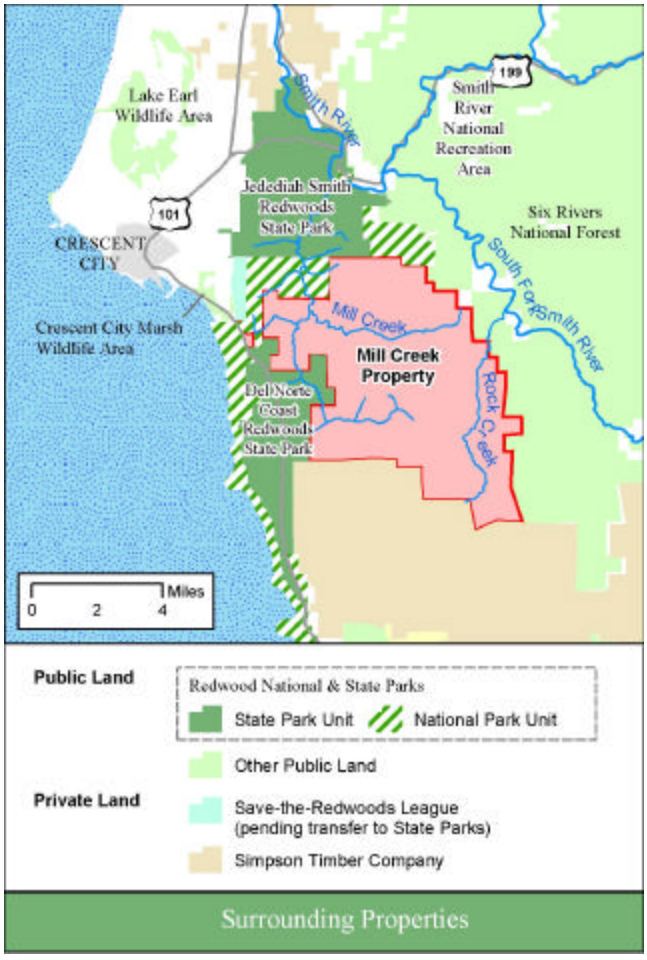


Figure 1-1. Regional location and context.

The Mill Creek property has a long history of timber harvest dating back to the 1850's. Hobbs, Wall, and Company established a mill and logging camp on the property in 1920. Miller-Rellim Redwood Company bought the Mill Creek tract from Hobbs, Wall, & Company in the early 1940s and the Rock Creek tract from Jones Timber Company in 1965. Save-the-Redwoods League (SRL) became interested in acquiring portions of the Mill Creek area from Miller-Rellim Timber Company before the rate of old-growth redwood timber harvest accelerated in the early 1950's. Between 1954 and 2000, the property was intensively managed for commercial timber harvest that included constructing an extensive road network and converting most of the property from old-growth to early-successional coniferous forest. Approximately 49 ha (121 ac) of old-growth redwood and Douglas-fir forest presently occur in five separate stands. In 2001, SRL negotiated an option to purchase the 103 km^2 (40 mi^2) Mill Creek property from Stimson Lumber Company (Stimson). Funding for the $60 million purchase was obtained from the Wildlife Conservation Board ($15 million), California Department of Parks and Recreation ($10 million), California Department of Fish and Game ($12.5 million), California Coastal Conservancy ($5 million), U.S. Fish and Wildlife Service ($2.5 million), and SRL and donors ($15 million). Sale of the property was finalized in June 2002, at which time the entire property transferred to State ownership under stewardship of the California Department of Parks and Recreation (DPR).

Stillwater Sciences, under contract to SRL and the California Coastal Conservancy, developed the following Interim Management Recommendations (IMR) to guide protection, restoration, and public use of the Mill Creek property until DPR adopts a General Plan for the area. Analyses and recommendations assume a maximum 10-year interim period, although the interim period could be considerably shorter. Management priorities will be refined during the interim period as new information and funding become available.

1.2 Purpose and Approach

The Mill Creek property was acquired by the State to protect and restore the property's ecological values, enhance regional ecological values by improving habitat connectivity between state and federal conservation areas, and provide opportunities for compatible public use. The acquisition goals were further described as follows in the Agreement on Terms and Conditions of title transfer:

- The primary goal is that the property shall be restored to late-successional forest characteristics and associated natural functions that maximize benefits to the salmonid species of its streams and wildlife associated with late-successional forest;

- Public access, that includes a broad array of park and other public uses such as improvements, will be sited, managed and operated in a manner that is compatible with and has minimal impact on the primary goal.

The intent of this document is to (1) synthesize and analyze existing resource information and (2) provide recommendations that can be used by DPR to develop appropriate interim management actions and complete the formal analysis of alternatives for a general plan that is compliant with the California Environmental Quality Act (CEQA) and related legislation (refer to section 1.4 for a summary of related legislation).

The planning process (Figure 1-4) involved initial scoping meetings with government agencies with stewardship and regulatory oversight, focused working groups, and the public to define important interim management issues related to the Mill Creek property. Issues raised during the scoping process included access and use; roads and infrastructure; aquatic and terrestrial habitat; vegetation management; fire hazard; and research, monitoring, and adaptive management. Refer to Appendix A for specific questions related to each of these issues.

Working groups were subsequently formed to help define desired future conditions and explore management alternatives for the following priority issues: (1) road management, (2) second-growth vegetation management, (3) aquatic resource protection and monitoring, and (4) public use. Working groups were comprised of SRL staff and Councilors, the Coastal Conservancy, National and State Parks, resource agencies, academia, and other knowledgeable resource professionals. Notes from the meetings are included in Appendix B.

Management recommendations were developed for each priority issue based on spatial analysis of potential risks and benefits to resources during the interim period. Draft recommendations completed in June 2002 were reviewed by federal, state and local agencies and working group participants. Final interim management recommendations were completed in August 2002.

The public was encouraged to participate during a series of three community meetings. The first community meeting was held in Crescent City on February 22, 2002 to discuss the planning process and solicit input on a broad range of management issues. A second community meeting was held in Crescent

Figure 1-2. Mill Creek property general features.

Figure 1-3. Mill Creek property public land survey system and USGS quadrangle reference.

City on June 12, 2002 to discuss analysis of interim management opportunities and solicit input on preliminary recommendations. A third community meeting will be held in September 2002 to discuss the final recommendations.

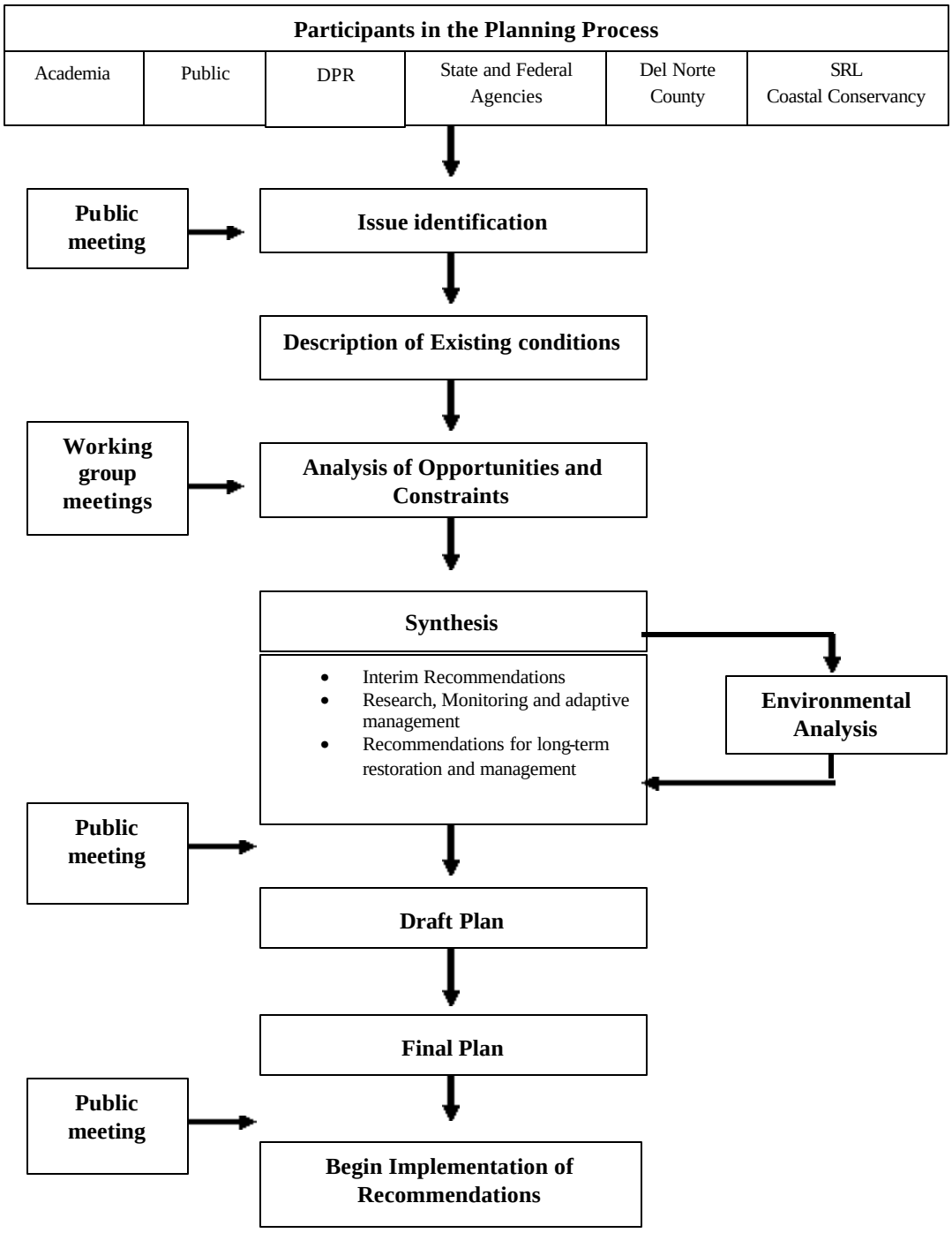


Figure 1-4. Planning process for developing the Mill Creek Property Interim Management Recommendations.

1.3 Goals and Objectives

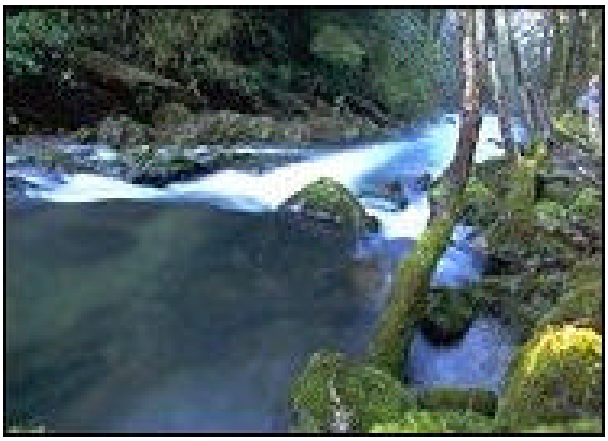
1.3.1 Goals

Long-term management goals were established for the Mill Creek property by SRL, DPR, and the state and federal resource agencies during the scoping process. The goals are to:

- protect and enhance existing old-growth and late-successional forests;
- restore complexity, diversity, and late-successional forest characteristics to young second-growth conifer plantations;
- restore the ability of the forest to withstand catastrophic wildfire;
- reduce potential impacts of the existing road network and other infrastructure on terrestrial and aquatic ecosystems;
- maintain and enhance high-quality spawning and rearing habitat for anadromous salmonids;
- provide public recreational and educational opportunities;
- manage site facilities and infrastructure (including roads, trails, buildings, and other park improvements) in a manner compatible with ecosystem protection and restoration; and
- establish a scientific research framework to guide adaptive management.

1.3.2 Objectives

The IMR describes (1) specific management objectives that support the above goals, (2) analyses to evaluate potential risks and opportunities, and (3) recommended actions for attaining objectives during the interim management period. Objectives, environmental analyses, and recommendations were developed during this interim planning process to prioritize future management actions, support funding initiatives, and synthesize information necessary for developing a general plan that is compliant with the California Environmental Quality Act (CEQA) and related legislation. The following interim management objectives were identified for each of the four major issues:



High gradient stream on the Mill Creek property.

Road management objectives

- Identify potentially unstable terrain where existing roads and landings may present a high risk to watershed values, and prioritize higher risk areas for detailed assessment and treatment.
- Identify road-stream crossings and log landings with the greatest potential to affect watershed values by failure or diversion, and prioritize higher risk sites for detailed assessment and treatment.
- Prioritize decommissioning of unnecessary roads with the greatest potential to affect aquatic resources.

Vegetation management objectives
- Identify and prioritize young, second-growth conifer stands where silvicultural treatments would accelerate development of late-successional characteristics.
- Identify and prioritize areas where vegetation management would reduce the risk of catastrophic wildfire.
- Identify areas affected by plant pathogens and appropriate treatments.

Aquatic and terrestrial habitat protection objectives
- Protect rare and important plant species and vegetation communities.
- Protect and enhance important existing and potential habitat for special status aquatic and terrestrial species.
- Protect and enhance aquatic habitats for anadromous and resident salmonids.

Access and use objectives
- Identify suitable areas for interim public access and use.
- Identify opportunities for environmental education.
- Identify research and monitoring needs.

1.4 Regulatory Context

The IMR for the Mill Creek property describes specific interim management objectives and recommended actions for attaining these objectives. Objectives and recommendations were developed to prioritize future management actions and provide information necessary for DPR to develop a CEQA compliant general plan and implement site-specific projects. In the interim period, prior to adoption of a General Plan by DPR, actions may be limited by Public Resources Code 5002.2 (c):

> *"…The Department is not required to prepare a general plan or to revise an existing plan, as the case may be, if the only development contemplated by the Department consists of the repair, replacement, or rehabilitation of an existing facility; the construction of a temporary facility, so long as such construction does not result in the permanent commitment of a resource of the unit; any undertaking necessary for the protection of public health or safety; or any emergency measure necessary for the immediate protection of natural or cultural resources; or any combination thereof at a single unit. Any development is subject to the requirements of the CEQA."*

California Environmental Quality Act (CEQA)
The Mill Creek property IMR is (1) a scoping document for development of a general plan that will require a formal CEQA process prior to adoption by DPR and (2) a tiering document for future site-specific projects that may individually require a formal CEQA process prior to implementation. The CEQA process informs governmental decision-makers and the public about potentially significant environmental effects of proposed activities and identifies actions that reduce adverse environmental effects below a level of significance. An initial study is conducted to determine if the project may directly or indirectly result in significant adverse environment effects. The initial study has three potential outcomes: (1) significant adverse effects, (2) significant adverse effects that can be mitigated to no significance, and (3) no significant adverse effects. If the project may have significant adverse effects, an Environmental Impact Report must be prepared. If the project will not cause significant adverse effects, a negative declaration is prepared. If the project may have significant adverse effects, but revisions to the project would avoid or mitigate the effects to a point of no significance, a mitigated negative declaration is prepared. State projects that do not have the potential for significant adverse effects may qualify for a Categorical Exemption from CEQA (Chapter 19 of the CEQA guidelines).

Federal Endangered Species Act (ESA)
The Mill Creek property supports several species listed under the Federal Endangered Species Act (ESA). These species are protected against "take", defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Take of listed species is prohibited without an incidental take permit (ITP). Incidental take permits are obtained through (1) a Section 7 consultation with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service or (2) a Section 10 habitat conservation plan (HCP). Section 7 applies if the activity has discretionary federal involvement or control (i.e., if the Mill Creek acquisition is included under the current MOU between the National and State Parks). If there is no such discretionary federal involvement, an ITP must be pursued under Section 10. Section 10(a) of the ESA specifies that an applicant for an ITP must prepare an HCP containing measures to (1) minimize and mitigate the impacts of any incidental take of listed species to the maximum extent practicable, and (2) ensure that incidental take will not appreciably reduce the likelihood of survival and recovery of that species in the wild. Research activities that may result in take of listed species require a research permit under Section 10(a)(1)(A) of the ESA. Fish monitoring in the Mill Creek basin is conducted under a NMFS Section 10(a)(1)(A) research permit. Implementation of the IMR should be conducted in a manner that avoids take of listed species.

California Endangered Species Act (CESA)
The California Department of Fish and Game (CDFG) has statutory authority for fish and wildlife and is responsible for ensuring that projects comply with CEQA. CDFG issues incidental take permits for state-listed species if another lead agency determines the project is CEQA compliant. Implementation of the IMR should be conducted in a manner that avoids take of listed species.

Clean Water Act Section 404
Discharge of dredge or fill material into navigable waters requires a permit from the Army Corps of Engineers. Permits are issued if the proposed activities are expected to cause minimal adverse environmental effects. Section 404 of the Clean Water Act pertains mainly to road management and development of water and wastewater systems on the Mill Creek Property. Future road management may not be subject to Section 404 permitting where roads are maintained in accordance with best management to protect water quality and minimize adverse effects on the aquatic environment.

California Department of Fish and Game sport fish regulations
The California Fish and Game Commission develops, administers, and enforces hunting and sport fishing regulations, including areas, seasons, bag limits, and methods. Recreational fishing and hunting regulations on the Mill Creek property are under CDFG jurisdiction.

Fish and Game Code Section 1600/1601: Lake and streambed alteration permit
Projects that divert, obstruct, or change the natural flow or the bed, channel, or banks of any river, stream or lake in which there are fish or wildlife resources require a 1601 permit. The permitting process involves completing CDFG notification and application procedures, including CEQA compliance. Various measures incorporated in these IMR, including culvert replacement and bridge installation, may require a 1601 permit.

California Department of Fish and Game Scientific Collecting Permit
A Scientific Collecting Permit (SCP) is required to "take, collect, capture, mark, or salvage for scientific, educational, and non-commercial propagation purposes mammals, birds and their nests and eggs, reptiles, amphibians, fishes, and invertebrates" (CDFG 2001). A SCP may not be issued for activities affecting state or federally endangered, threatened, and candidate species. A Section 2081(b) permit may be required if the project results in incidental take of threatened or endangered species. Mitigation and monitoring may require a SCP if handling of animals is involved. A Rare, Threatened, or Endangered

Plant Collecting permit or Plant Research permit may be required if a project requires handling of rare, threatened, or endangered plants.

California Department of Parks and Recreation Investigation and Collection Permit
Research conducted within the State Parks requires a California State Parks Investigation and Collection permit, in addition to permits required by other agencies. An Investigation and Collection permit can be obtained by submitting a study proposal with copies of all other required permits to DPR.

Z'Berg-Nejedly Forest Practice Act (PRC Section 4511)
Timber operations (as defined by Public Resources Code Section 4522) on land managed by DPR are exempt from the provisions of the Z'Berg-Nejedly Forest Practice Act (Public Resources Code Section 4511), provided those operations are CEQA compliant (Public Resources Code Section 21000).

Surface Mining and Reclamation Act of 1975
The Surface Mining and Reclamation Act (SMARA) requires a permit from the California State Mining and Geology Board for surface mining operations that disturb more than one acre or remove more than 1,000 cubic yards of material. Surface mining operations include prospecting and exploratory activities, dredging and quarrying, streambed skimming, and stockpiling mined materials. SMARA applies to rock pits used by Stimson to mine gravel for road maintenance and construction on the Mill Creek property. SMARA requires that abandoned mines be reclaimed and restored. Reclamation plans should include recontouring, revegetation, erosion control, and other measures to protect water quality and other natural resources.

1.5 Existing Management Plans

Several past and present plans address natural resource management of the Mill Creek property or adjacent public lands. These plans were reviewed during development of the Mill Creek IMR and are described briefly below.

Stimson Lumber Company Draft Habitat Conservation Plan
Stimson Lumber Company prepared a Draft Multi-Species Habitat Conservation Plan (HCP) for their timberlands in Del Norte County, California in support of an application for an ITP under the ESA and a 2081(b) permit under CESA (Stimson Lumber Company 1998). The HCP summarized existing physical and biological information for the property, as well as potential impacts to threatened, endangered, and other special-status species that could result from timber harvest activities. The HCP did not undergo a public review process and was not finalized by Stimson or federal and state agencies.

Smith River National Recreation Area Management Plan and Six Rivers National Forest Land and Resource Management Plan
The Smith River National Recreation Area (SRNRA) was established as part of the Six Rivers Land and Resource Management Plan (SRLRMP) to "ensure the preservation, protection, enhancement, and interpretation of the Smith River's wild and scenic rivers, ecological diversity, and recreational opportunities while providing for wise use and sustained productivity of its natural resources" (USDA Forest Service 1995). The SRLRMP provides management guidance for a 10- to 15-year period.

Smith River Anadromous Fish Action Plan

The Smith River Anadromous Fish Action Plan was prepared by the Smith River Advisory Council to maintain and enhance anadromous fish populations in the Smith River (SRAC 2002). The plan addresses anadromous salmonid habitat quality and quantity, watershed conditions, and public land management in the Mill Creek area. Goals established in the plan include (1) assessing watershed conditions in the Smith River estuary and tributaries, (2) identifying existing data gaps, (3) formulating management and monitoring recommendations, (4) maintaining natural resource-based economies, and (5) community participation in natural resources management and restoration.

Redwood National and State Parks General Management Plan

Redwood National Park, Jedediah Smith Redwoods State Park, Del Norte Coast Redwoods State Park, and Prairie Creek Redwoods State Park are cooperatively managed under an MOU between the NPS and DPR (RNSP 1996). The MOU includes lands within the congressionally authorized boundary of Redwood National Park, referred to as Redwood National and State Parks. Joint state and federal management is intended to enhance protection of park resources and improve public service using combined state and federal resources. A General Management Plan and Environmental Impact Statement/Environmental Impact Report were prepared by the Redwood National and State Parks to provide "a defined, coordinated direction for resource preservation and visitor use and a basic foundation for decision making and managing for the following 15 to 20 years" (RNSP 1999). The joint plan, approved in 2000, covers approximately 427 km^2 (165 mi^2) and focuses on park establishment, cooperative management of park resources, and the visitor experience. The Mill Creek property lies outside the cooperative management boundary designated by congress.

Draft Second-Growth Forest Recovery Plan and Draft Environmental Assessment

Throughout the Redwood National and State Parks, second-growth conifer forests have established following timber harvest that occurred prior to state and federal acquisition (RNSP 1996). Late-successional forest characteristics and associated ecological values are generally lacking and develop slowly in these dense second-growth forests. RNSP developed a Draft Second-Growth Forest Recovery Plan with the goal of accelerating recovery of late-successional characteristics in these areas through silvicultural treatments. The draft plan assesses the benefits and potential impacts of vegetation management alternatives, including a no treatment alternative.

Forest stand on the Mill Creek property.

Chapter 2

Existing Conditions

2 EXISTING CONDITIONS

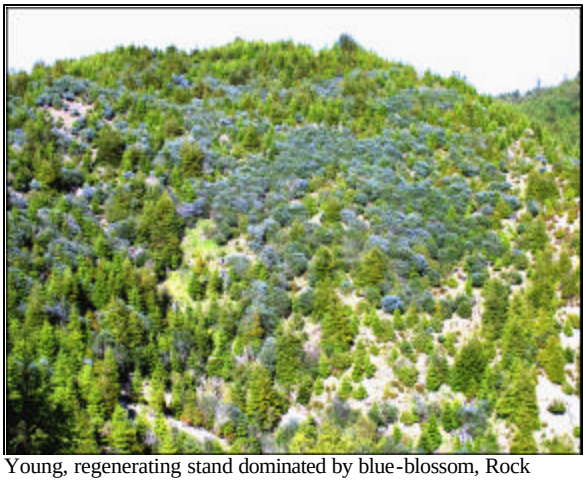
2.1 Land Use History and Existing Infrastructure

2.1.1 Commercial timber harvesting

Timber harvest on the Mill Creek property began in the 1850s, and most of the area has been logged at least once since the 1920s. Windthrow, wildfire, and forest pathogens were the main disturbances influencing stand age distribution and species composition prior to initiation of large-scale commercial timber harvest.

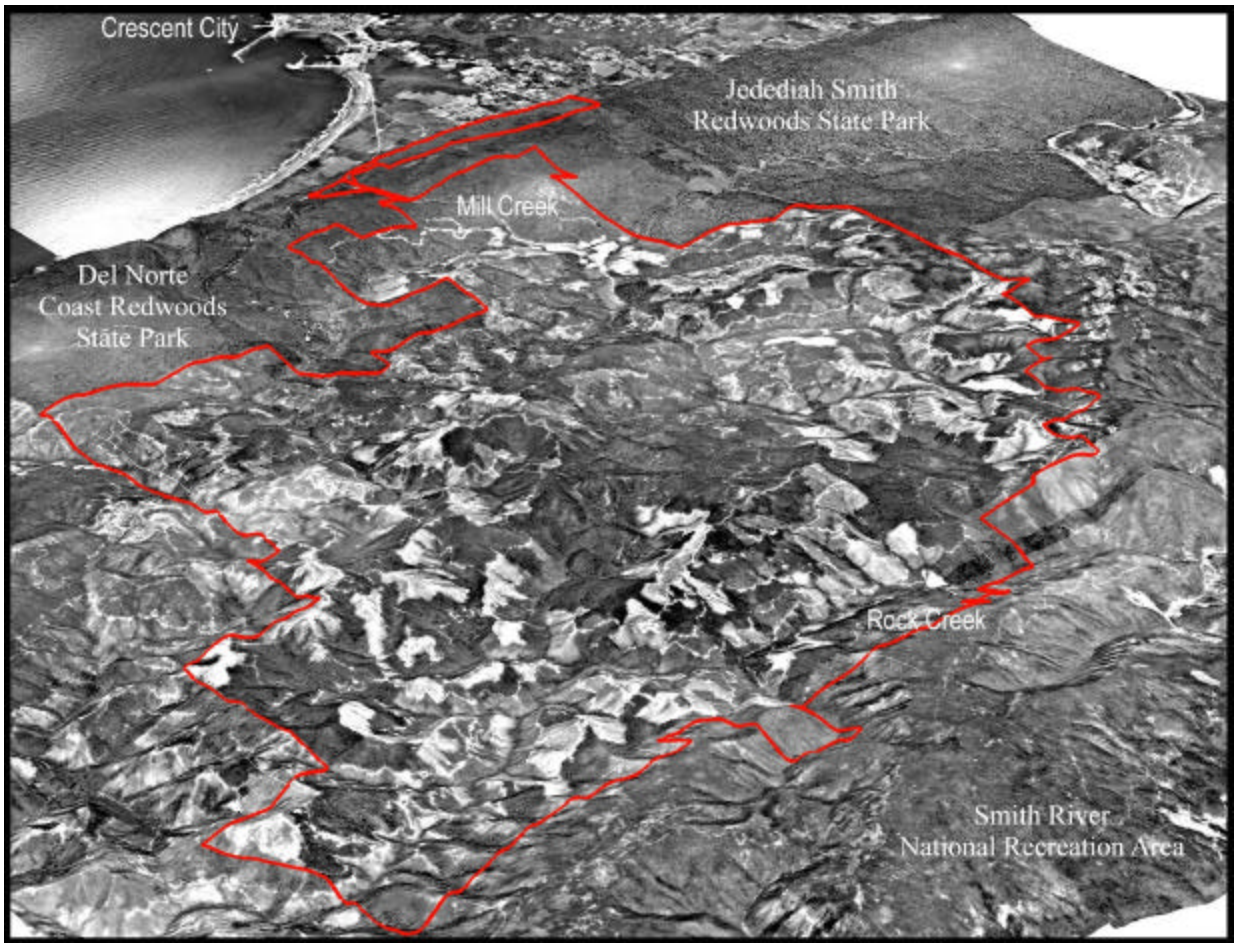
Early silvicultural management
The earliest logging in the Mill Creek drainage began in the 1850's. Hobbs, Wall, & Company began logging in the Mill Creek basin around 1920. Harold Miller purchased the Mill Creek portion of the property in the around 1940 and the Rock Creek portion of the property in 1965. Refer to Madej et al. (1986) for a thorough history of land use in the Mill Creek basin through 1984.

Silvicultural management by Stimson Lumber Company
The silvicultural methods employed by Miller-Rellim and Stimson Lumber Company on the Mill Creek property generally consisted of three phases: (1) stand establishment, (2) pre-commercial thinning, and (3) commercial thinning. Stand establishment typically spanned from year 0 (year of disturbance or initial site regeneration) through year 10. Logging disturbance often created ideal circumstances for colonization and rapid growth of non-conifer species. Herbicide applications were the primary method of controlling broadleaf hardwood trees and shrubs that colonized sites following timber harvest and site preparation burning. These treatments were conducted with the intent of promoting conifer dominance as early as possible


Young, regenerating stand dominated by blue-blossom, Rock Creek.

Pre-commercial thinning was typically conducted from years 12-18. Thinning was performed to (1) ensure that stands did not deteriorate from overcrowding, and (2) promote growth on the fewest possible stems while maintaining maximum site potential. This practice tended to promote healthier, more vigorous growth and ultimately higher-quality timber by removing inferior phenotypes and deformed or suppressed trees. Commercial thinning was conducted from years 30-45 years (K. Stowe, pers. comm., 2002) following standards contained in Forest Practice Rules (FPR) 14 CCR 913.3. Post-logging treatment typically involved broadcast burning and herbicide application.

The Forest Practice Act of 1974 mandated restocking of logged stands. Planting of seedlings on the Mill Creek property began in the late 1970s with nursery stock obtained from off-site sources. A scarcity of seed resulted in construction an on-site nursery by Stimson Lumber Company around 1982. Seed sources varied according to availability. Cones were collected on site only when seed from an appropriate source could not be procured on the market. There is no record of seed sources used on the property.



Aerial photograph showing the Mill Creek property and adjacent National and State forests.

Effects of silvicultural management on stand composition

Old-growth redwood stands received the highest priority for harvest during initial logging activities. Regenerating stands were often dominated by Douglas-fir because surrounding seed blocks contained higher densities of Douglas-fir, and because redwoods were less successful at regenerating in the bare mineral soil that remained following tractor logging and site preparation burning. Some stands today likely have a much higher Douglas-fir component as a result.

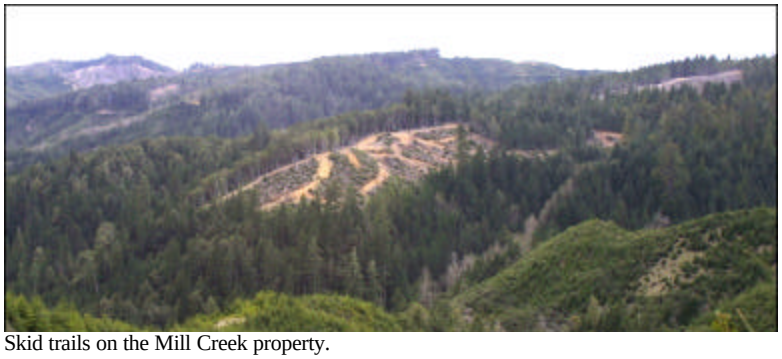
2.1.2 Roads

Approximately 410 km (255 mi) of roads occur on the Mill Creek property (Table 2-1). Average road densities are 4.2 km/km^2 (6.7 mi/mi^2) in the Mill Creek basin and 3.8 km/km^2 (6.1 mi/mi^2) in the Rock Creek basin. The majority of the existing roads were constructed between 1958 and 1977 to provide access to timber. Refer to Madej et al. (1986) for a history of road construction in the Mill Creek basin through 1984 and Pacific Watershed Associates (1996, 1997, 1998) for road-related activities in the Mill and Rock Creek basins between 1984 and 1997.

Table 2-1. Summary of road characteristics by subwatershed.

Subwatershed Planning Area[1]	Drainage Area		Length of Road		Road Density		Bridges	Crossings[2]	Road Length in Watercourse Protection Areas	
	km^2	mi^2	km	mi	km/km^2	mi/mi^2			km	mi
Rock Creek	30.9	11.9	117	72.6	3.8	6.1	2	236	43.8	27.2
East Fork Mill Creek	20.5	7.9	88	54.7	4.3	6.9	2	128	37.6	23.4
West Branch Mill Creek	19.6	7.6	84	52.5	4.3	6.9	3	120	34.0	21.1
Mainstem Mill Creek	10.8	4.2	45	28.2	4.2	6.7	3	46	18.2	11.3
Bummer Lake Creek	9.5	3.7	39	24.2	4.1	6.6	1	75	14.8	9.2
Wilson Creek	5.3	2.0	21	13.0	4.0	6.4	0	1	5.1	3.2
Terwar Creek	2.6	1.0	11	6.6	4.0	6.4	0	18	4.3	2.7
Jordan	2.2	0.9	1	0.7	0.5	0.8	0	0	0.8	0.5
Hunter Creek	1.1	0.4	3	1.6	2.5	4.0	0	2	0.4	0.2
Smith Plain	0.3	0.1	1	0.4	2.3	3.7	0	0	0.0	0.0
Total	**102.8**	**39.7**	**410**	**254.5**	**4.0**	**6.4**	**11**	**626**	**159.0**	**98.8**

[1] Modified Northern California Hydrologic Subareas delineated by Calwater.
[2] Crossings are based on 1995-1997 inventories by PWA. The number of crossings may differ from that reported by PWA (1996, 1997, 1998) due to differences in watershed boundaries and road locations, uncertainties in site attributes, and missing site coordinates.


Skid trails on the Mill Creek property.

Four general types of roads occur on the property: (1) paved roads (Hamilton Road between Highway 101 and the old mill site), (2) haul roads and spur roads with a crushed rock surface, (3) spur roads with no surfacing, and (4) decommissioned or abandoned roads. Hamilton Road is the primary access road into the property and the most suitable road for providing public access to the future State Park. Most of the 8.2 km (5.1 mi) of Hamilton Road between Highway 101 and the mill site is paved. In November 1998, a bridge and portions of the road grade between the main Stimson gate and West Branch Mill Creek failed. Approximately 0.5 km (0.3 mi) of road was rerouted to the left bank of

Hamilton Creek and surfaced with crushed rock. Section 31 Road is the only other existing access road into the property and accesses the Rock Creek portion of the parcel through adjacent private industrial timberland in the upper Terwar basin.

Childs Hill Road, Rock Creek Road, West Branch Road, and Bummer Lake Road are the main (haul) roads on the parcel. Childs Hill Road and Rock Creek Road, which intersect near the confluence of the East and West branches of East Fork Mill Creek, form a 43.8 km (27.2 mi) loop through the parcel, (Figure 1-2 and Figure 1-3). Haul roads and most spur roads were designed to be a single lane with a 14-ft running (driving) surface width at grades usually less than 15 % (Stimson Lumber Company 1998). The majority of the road network is named and signed at intersections. Stimson Lumber Company regularly inspected and maintained the large rock-surfaced road network to ensure proper drainage function and subgrade stability. Crushed rock used for road surfacing was mined from numerous borrow sites located throughout the property. Large permanent borrow sites are located (1) north of Maple Creek (T15N, R2E, section 19), (2) near the administrative buildings at the mill site (T16N, R1E, section 31), and (3) on Rock Creek Road south of Lower Spur Road (T15N, R1E, section 4) (Figure 1-3). Several spur roads link to trails on adjacent properties, including the Rellim Trail north of the property and the Bald Hills Trail on the Six Rivers National Forest in the north-east part of the property.

Approximately 97 km (60 mi) of roads were decommissioned in 2001-2002. Stimson's road decommissioning treatments were intended to reduce potential erosion volume and diversion potential at stream crossings while leaving culverts and the existing roadbed between crossings in place for reentry during future timber harvest operations. These treatments reduced the potential erosion volume at crossings but did not effectively remove the risk of failure, and in some cases, created obstacles to routine maintenance necessary to minimize future erosion. Stimson has no implementation records for decommissioned sites.

2.1.3 Buildings

There are 12 vacant buildings or structures located within the 37-ha (91-ac) mill site. These include the forestry center building, veneer plant building, steam vat building, resaw building, planer shed, hyster shop, main office building, cat shop, oil shed, rigging shed, truck shop, and tee pee burner. Several small sheds are found in the same area, and a guard shack is located at the front gate. (K. Stowe, pers. comm., 2002). Much of the area surrounding buildings at the mill site is cleared of vegetation and surfaced with asphalt or concrete. Several buildings are located within 0.4 km (0.25 mi) of the "Hamilton Buffer" old-growth stand. One large building is located within 0.4 km (0.25 mi) of the "Planing Shed" old-growth stand.

2.1.4 Water supply and wastewater

There is no functioning infrastructure for potable water on the property. The water system that supplied the mill site was constructed around 1964 and consisted of a 1.5 million-gallon reservoir used for fire fighting and domestic water supply. The reservoir is an excavated depression that retains water without the use of a check dam. When the water system was fully operational, the reservoir was filled using water pumped from the confluence of the West Branch and East Fork of Mill Creek. Water was delivered from the reservoir to buildings at the mill site by gravity-flow through galvanized pipes. Water used in the buildings did not undergo any treatment to make it potable. All supply lines to buildings at the mill site have been dismantled and removed. The system was apparently in poor condition and prone to failure prior to being dismantled (K. Stowe, pers. comm., 2002). The septic system has been dismantled, and the tanks have been filled and buried (K. Stowe, pers. comm., 2002).

The Mill Creek campground, located on State Park property south of the Mill Creek property, extracts water from the West Branch of Mill Creek. This diversion may impact aquatic and riparian habitat during the summer flow period. The National and State Parks and the USGS plan to evaluate potential negative impacts of the campground diversion on downstream reaches of Mill Creek (M. Madej, pers. comm., 2002).

2.1.5 Other considerations

Interim and long-term management of the Mill Creek property must consider the following infrastructure located on adjacent private and public lands.

Highway 101 alternative
The portion of Highway 101 north of Wilson Creek, called Last Chance Grade, traverses unstable slopes chronically prone to failure. Locally steep slopes comprised of deep-seated landslides that extend to the coastal shoreline may prohibit stabilization of the roadway within the existing right-of-way. Caltrans is currently evaluating long-term alternatives for stabilizing or rerouting this section of the highway. One or more of these alternatives may involve rerouting the highway inland through the western portion of the Mill Creek property.

Powerline right-of-way
A major transmission line that serves the community of Klamath was constructed along the border of the Mill Creek property in 1993. The corridor easement is 91 m (300 ft) wide and follows the northwest border of the property until it reaches T15N, R1E between sections 5 and 8 (Figure 1-3). The transmission corridor then continues along a north-trending ridge to a transfer station at the old mill site. Interim and long-term management of the Mill Creek parcel must allow access to and maintenance of the transmission line in perpetuity.

2.2 Climate and Storm History

The Mediterranean climate of northern California is characterized by cool, wet winters and warm, dry summers with frequent fog. The Mill Creek property is located within the western portion of the California Coast Range Province known as the coastal fog belt, which extends to Rattlesnake Ridge along the eastern edge of the Mill Creek property. Precipitation in this area occurs primarily as rain during the winter months. Mean annual precipitation ranges from 152 to 381 cm (60-150 inches). Average monthly maximum and minimum air temperatures in Crescent City vary from 8 to 19°C (41 to 67°F). The maritime influence diminishes with distance inland from the coast, resulting in less fog, drier summer weather, and more variable seasonal and diurnal temperatures.

Large magnitude storms contribute most of the winter rainfall in north coastal California, and the floods generated by intense winter storms are an important geomorphic agent controlling mass wasting, road-stream crossing and landing failure, and stream channel morphology. There are three basic types of major storms in California: (1) high-latitude storms originating from the Gulf of Alaska, (2) low-latitude storms originating in the western Pacific, and (3) mid-latitude storms associated with low pressure cyclones that generally originate from polar regions but are extensively modified during passage over the Pacific Ocean (Weaver 1962). Mid-latitude storms are favored by zonal circulation characterized by relatively unobstructed east-west airflow, while high and low latitude storms are favored by meridional flow when westerlies develop a large north-south component (Coghlan 1984). In all three cases, the occurrence of highly intense precipitation depends on the presence of a strong flow of moist air from low latitudes. The

effects of large storms are heavily influenced by the types of past and existing land uses, especially timber harvest and road construction.

Flood of November 1998 in Prairie Creek, Redwood National and State Parks.

During the period of historic records, a high incidence of large storms occurred during three periods in the north coast region. The most recent period occurred during 1997 and 1998, when large storms triggered widespread flooding and geomorphic change in northern California watersheds. In 1997, Redwood Creek experienced its highest peak discharge since 1975, equivalent to a 12-year recurrence interval. Maximum 6-hr rainfall intensity was 2.5 in (2-year rainfall event) and maximum 24-hr rainfall intensity was 7.6 in (10-yr rainfall event) (Harris et al. 1997). Road inventories conducted in Redwood Creek following the storm indicated that for 20 miles of rehabilitated road, fluvial erosion at previously excavated crossings and gullies produced 140 yd^3/mi and mass movement produced 585 yd^3/mi (Harris et al. 1997). An inventory of 80 miles of untreated roads showed less fluvial erosion at crossings (38 yd^3/mi) but greater mass movement (1,288 yd^3/mi) (Harris et al. 1997). Much of the mass movement was from side cast failures.

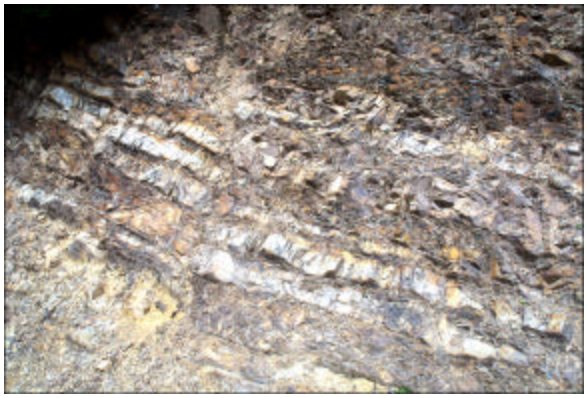
A second period of six flood-producing storms occurred between 1953 and 1975. These damaging floods each produced instantaneous peak discharges of about 1,400 m^3 in Redwood Creek at Orick and had a long-term recurrence interval of about 25 years (Harden 1994, Coghlan 1984). During this period, major floods occurred at the Smith River gage in 1955, 1964, 1972, and 1975. Average long-term recurrence interval of December 1964 size storms and December 1955 size storms estimated from historical records, geomorphic evidence, and climatologically analyses are 45-50 years and 25-30 years, respectively (Coghlan 1984). Although the 1964 storm is the largest on record, no major increase in the number of landslides was observed in the Mill Creek basin as a result of the event (Stimson 1998). A third period of at least five flood-producing storms occurred between 1861 and 1890. Although these storms were comparable to those from 1953 to 1975, they appear to have had less severe and lasting geomorphic effects due to preconditioning of watersheds by human disturbance during the last 50 years (Helley and LaMarche 1973, Harden 1994).

2.3 Geology and Geomorphology


Rock Creek basin.

The Mill Creek property is characterized by steep, mountainous terrain typical of the outer northern California Coast Ranges. Elevations range from 61 m (200 ft) above mean sea level, to approximately 732 m (2,400 ft) at the crest of Childs Hill (Figure 2-1). The ridges or drainage divides are generally broad and gently sloping. Hillslopes are steep and straight to convex upwards with gradients that frequently exceed 50% (Madej et al. 1986). Drainage basin patterns are predominantly dendritic with drainage densities ranging from 4.5 to 5.5 km/km^2. Smaller tributaries occupy narrow, deeply incised canyons with bedrock floors and little floodplain development. The main stem of Mill Creek and the lower reaches of the West Branch and East Fork occupy broad, flat valley bottoms that store large volumes of stable sediment in terraces located above the active channel. These terraces tend to buffer sediment input and yield by protecting the base of hillslopes from erosion (Madej et al. 1986). Rock Creek flows through a narrow valley for most of its length.

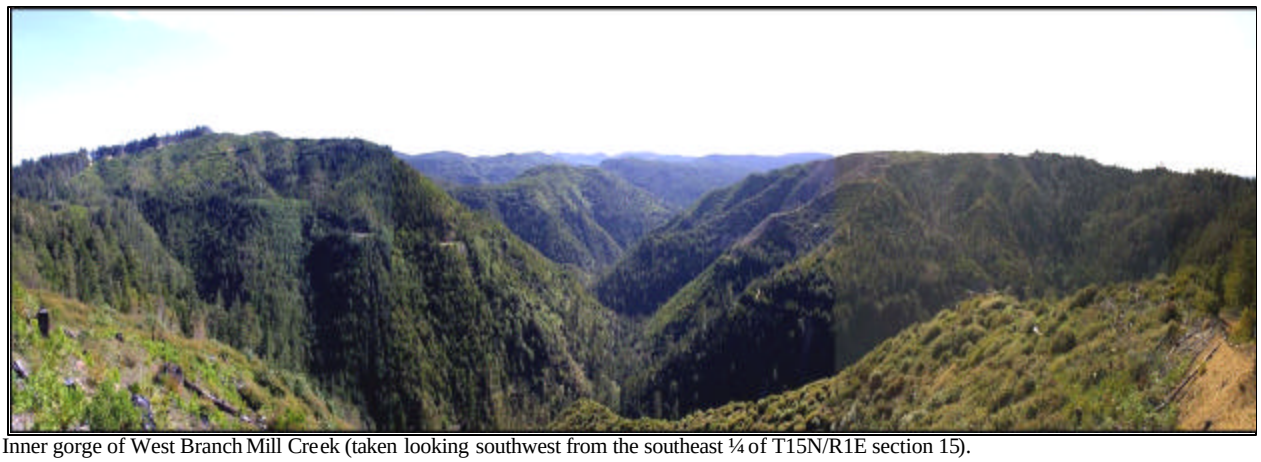
Bedrock geology in the Mill Creek project area is predominately the Broken Formation of the Eastern Belt Franciscan Complex. Broken Formation rocks are Late Jurassic to early Cretaceous in age and are comprised of tectonically fragmented and interbedded greywacke, shale, and conglomerate (Aalto and Harper 1982). Most of the sandstones and shales are classified as unmetamorphosed, although slightly metamorphosed rocks are exposed at Bald Hills (Madej et al. 1986). A coherent sandstone unit, common in the Mill Creek basin, is characterized by massive sandstone bedding and moderate shearing and fracturing which results in steep, straight hillslopes (Harden et al. 1981 in Madej et al. 1986). The degree of shearing and fracturing increases from west to east toward the South Fork fault. The north-northwest trending South Fork fault intersects the eastern corner of the Mill Creek basin at Bald Hill, then follows the northwestern trend of Rattlesnake Ridge through the Rock Creek drainage. This fault separates the Eastern Belt Franciscan complex from the Western Klamath terrain. Bedrock just west of the fault is composed of highly sheared and foliated metagraywacke, argillite, and semischist (Davenport 1984). Bedrock east of the fault is composed of highly sheared serpentinite and peridotite (Aalto and Harper 1982). Shallow water marine deposits of the Miocene-age Wimer Formation cap the highest ridge crests in the northern portion of the property. Remnants of uplifted, Pliocene-age alluvial terrace deposits cap ridge crests in the Childs Hill area. Alluvial terrace and floodplain deposits of Pleistocene to Holocene age occur in valley bottoms along Mill Creek, East Fork Mill Creek, West Branch Mill Creek, and Rock Creek.


Thinly bedded sedimentary rocks on the Mill Creek property.

Soils on the Mill Creek property are highly varied due to changes in parent material, slope position, and climate. The predominate soil types in the Mill Creek basin are the Melbourne and Josephine associations. These soil series have a moderately high-to-high erosion potential (Madej et al. 1986). Serpentine and peridotite parent material common in the Rock Creek basin weather to strong alkaline soils of the Weitchpec and Cornutt series (Madej et al. 1986).

2.4 Erosion and Mass Wasting

Stimson Lumber Company conducted an assessment of mass wasting and road-related erosion during preparation of their draft HCP (Stimson Lumber Company 1998). The assessment was based on interpretation of sequential aerial photography dating from 1958 to 1997, supplemented by field mapping. The location and type of landslide, slope form, landform, and land-use were noted during the mapping. Landslide densities were consistent across the property, ranging from 5.25 slides/mi^2 in Rock Creek to 6.05 slides/mi^2 in West Branch Mill Creek. The majority of slides (52 %) occurred within deeply incised inner gorges. Inner gorge landslides were most common where (1) sidecast fill from road and log landings had failed, (2) stream crossing structures failed catastrophically during high flows, and (3) clearcut units extended to the streambank. Inner gorge landslides were common along the entire length of Rock Creek where steep sideslopes directly abut the channel. A smaller number of failures (16 %) originated from hillslope hollows, the majority of which were associated with altered drainage patterns and failure of road fill slopes. Large, deep-seated landslides were mapped in the East Fork Mill Creek and Bummer Lake subbasins and along the eastern side of the Rock Creek basin. Road construction and disruption of the drainage network has reactivated several of these deep-seated features. Roads were estimated to account for over 50% of estimated total sediment input between 1958 and 1997. Most of the road-related sediment production originated from sidecast fill and log landing failures (47%), followed by debris flows (28%), and gullies and stream crossings (25%). The draft HCP (Stimson 1998) concluded that (1) road-related erosion represented the largest and most preventable source of sediment, (2) altered drainage pathways associated with roads was a major cause of instability, and (3) streamside landslides from inner gorge landforms were a major source of sediment that increased in frequency due to timber harvest.



Inner gorge of West Branch Mill Creek (taken looking southwest from the southeast ¼ of T15N/R1E section 15).

Pacific Watershed Associates (PWA) conducted systematic inventories of log landings, roads, and adjacent hillslope conditions on the Mill Creek parcel in 1995-1997 (PWA 1996, 1997, 1998). The purpose of the inventories was to (1) identify existing and potential sediment sources along active and abandoned roads, and (2) to develop prescriptions for cost-effective erosion prevention work that would minimize future sediment yield to the stream network (PWA 1996). The inventories included descriptions of road-stream crossings, road-related landslides, and log landings; potential for culvert plugging, stream diversion, and erosion; estimates of past and potential future erosion volumes; and treatment immediacy. Approximately 261 km (162 miles) of roads were inventoried in the Mill Creek basin and 151 km (94 miles) of roads were inventoried in the Rock Creek basin (PWA 1996, 1997, 1998). Most of these were permanent, rock-surfaced roads. Seasonal, unsurfaced roads were uncommon and abandoned roads were rare. Less than 5 % of all roads in the Mill Creek basin and approximately 12 % of all roads in the Rock Creek basin were abandoned at the time road surveys were conducted in 1996-1997, a small percentage compared to other

Figure 2-1. Mill Creek property topography.

private industrial forest lands in northwestern California (PWA 1997). A total of 495 potential future sediment source sites representing a potential future sediment yield of 88,180 m^3 (115,340 yd^3) was identified in the Mill Creek basin, including 102 road-related landslides and 383 stream crossings (Table 2-2). A total of 409 potential future sediment source sites representing a potential future sediment yield of 180,960 m^3 (236,700 yd^3) was identified in the Rock Creek basin, including 115 road-related landslides and 267 stream crossings. Surveys indicated the potential for diversion to occur at 318 stream crossings in the Mill Creek basin and 139 crossings in the Rock Creek basin. PWA concluded that most future erosion and road-related sediment yield in the Mill Creek and Rock Creek watersheds was likely to come from three primary sources: (1) failure of road and landing sidecast fill, (2) erosion at or associated with stream crossings, and (3) road surface and ditch erosion (PWA 1997, 1998).

Double-barrel culvert on West Branch of East Fork Mill Creek.

Table 2-2. Estimated sediment yield from sites inventoried in the Mill Creek and Rock Creek watersheds (PWA 1996, 1997, 1998).

SITE TYPE	MILL CREEK					ROCK CREEK				
	# of sites	Past erosion volume		Potential future sediment yield		# of sites	Past erosion volume		Potential future sediment yield	
		m^3	yds^3	m^3	yds^3		m^3	yds^3	m^3	yds^3
Stream crossings	383	6,110	7,990	63,970	83,670	267	12,550	16,420	108,150	141,460
Road-related landslides	102	7,250	9,480	23,980	31370	115	32,230	42,150	72,500	94,830
Ditch relief, gully, and surface erosion	10	1,630	2,130	230	300	27	940	1,230	310	410
Total	**495**	**14,990**	**19,600**	**88,180**	**115,340**	**409**	**45,720**	**59,800**	**180,960**	**236,700**

Note: Current potential erosion volumes will vary from those reported here based on recent erosion and undocumented management practices implemented since the surveys were conducted.

2.5 Hydrology

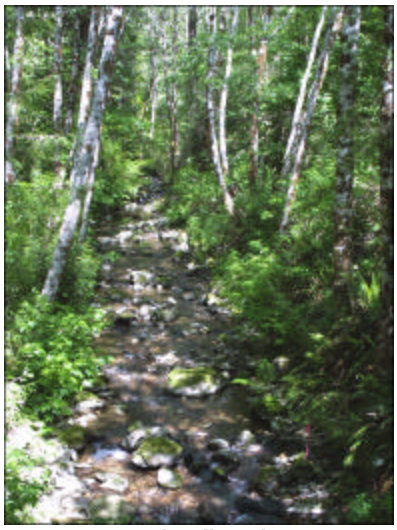
The Mill Creek property encompasses portions of five watersheds: Mill Creek, Rock Creek, Wilson Creek, West Fork Hunter Creek, and Terwar Creek. Mill Creek and Rock Creek are tributary to the Smith River; Terwar and Hunter Creek are tributary to the Klamath River; and Wilson Creek flows to the Pacific Ocean. These basins were divided into ten planning areas based on modified Northern California Hydrologic Subareas delineated by Calwater (Figure 1-2, Table 2-1).

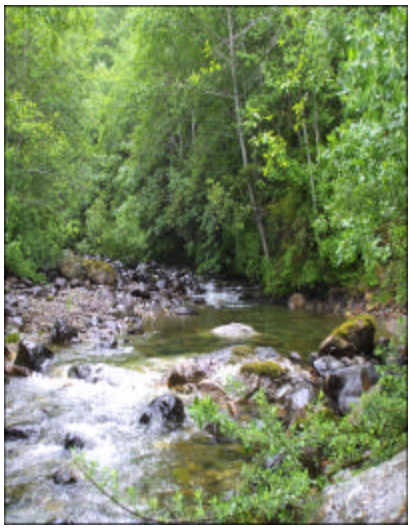
The USGS monitored streamflow and sediment discharge of Mill Creek from 1974-1981. The Mill Creek stream gauge was located on parklands adjacent to the Mill Creek property approximately 1 km (0.6 mi)

downstream of the East Fork and West Branch confluence (drainage area 74.1 km^2). Over the seven-year period of record, the mean annual discharge was 3 m^3/s (118 cfs). The lowest and highest mean daily flows were 0.07 m^3/s (2.5 cfs) and 84 m^3/s (2,980 cfs), respectively. The peak recorded flow was 126 m^3/s (4,460 cfs) on March 18, 1975 (Madej et al. 1986). The Mill Creek hydrograph closely mimics the Smith River, although the Smith River has a higher runoff-per-unit-area than Mill Creek (Madej et al. 1986). Refer to Madej et al. (1986) for flow frequency and flow duration curves for the Mill Creek basin. Rock Creek is ungaged and little is known about the basin's hydrology. The Rock Creek basin likely responds more quickly to storm runoff and has lower summer base flows than Mill Creek due to its higher overall gradient, smaller size, more inland location, and more arid climate.

2.6 Stream Channel Characteristics

Stream morphologies on the Mill Creek property vary from colluvial, boulder-cascade, step-pool, and bedrock channels in upper basin positions to forced pool-riffle and plane-bed alluvial channels in lower basin positions. The USGS, in collaboration with the NPS, established 11 monumented cross-sections throughout the Mill Creek watershed. The median particle size (D_{50}) of the bed material at these cross sections ranged from 22 to 90 mm, the D_{50} of the bedload material ranged from 2 to 22 mm, and the D_{50} of the suspended sediment load was commonly 0.022 mm (Madej et al. 1986). Cross-sections were resurveyed during the summer each year between 1974 and 1980, and most were resurveyed annually by the NPS from 1982 to 1990. Cross-sections located on public land were resurveyed in 1999, but cross-sections located on Stimson land, have not been surveyed since 1990. Channel cross sections changed the most at pronounced breaks in gradient. Removal of a logjam and replacement of a culvert with a bridge in the Mill Creek campground in 1989 resulted in minor channel changes in this area. Between 1990 and 1999, aggradation and channel widening occurred in the Mill Creek campground area in response to large sediment inputs from upstream. Over a meter of aggradation has occurred at the mouth of Mill Creek since 1930 (Madej et al. 1986). All of the cross sections will be resurveyed during the summer of 2002.

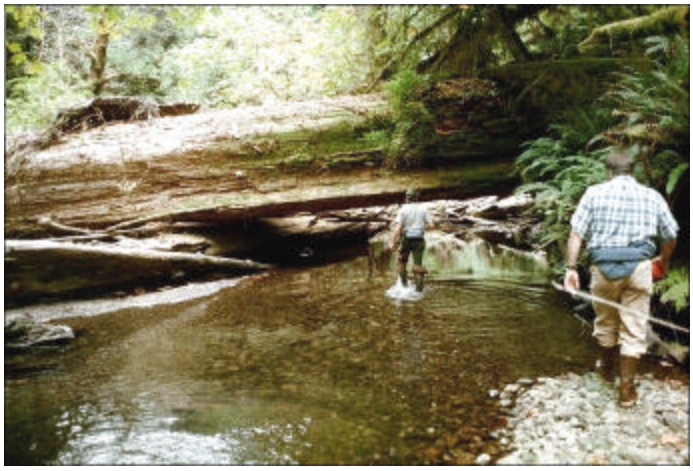

Upper West Branch Mill Creek


Mainstem Rock Creek


East Fork Mill Creek

Stream cleaning or removal of LWD was routinely conducted in streams on the Mill Creek property until as recently as 1992 (Verhey and Schwabe 1993, as cited in Stimson Lumber Company 1998). Surveys of LWD were conducted in eight streams on the Mill Creek property during March 1997 (Stimson Lumber Company 1998). Large woody debris abundance varied widely within and between different channel

types. LWD was generally most abundant in West Branch Mill Creek and least abundant in the Rock Creek drainage. Conifers, primarily redwoods, accounted for most in-channel LWD. Some of this LWD was "legacy wood" that entered the channel prior to or during initial timber harvesting. Forest stands adjacent to many low-gradient channels on the property are currently dominated by hardwoods and lack large conifers necessary for long-term recruitment and retention of instream LWD. The survey concluded that 12% to 54% of all pieces inventoried were functional and provided bank protection, sediment storage, pool formation, or anchors for log jams. Bank protection and pool formation were the two most common functions of LWD in low-gradient channels on the property. Energy dissipation and anchoring of jams were the most common functions provided by LWD in moderate-gradient channels. Overall, approximately 5% to 30% of the pieces were found to be important in forming pools. These values are similar to studies conducted in the Pacific Northwest by Montgomery (1995) in which 10% to 30% of all in-channel LWD were important in forming pools.



Channel-spanning LWD in Prairie Creek, Redwood National and Sate Parks.

2.7 Water Quality

2.7.1 Water temperature

Water temperatures have been collected on and near the Mill Creek property since 1973 (Winzler and Kelley 1980, Madej et al. 1986). Water quality data collected between 1973 and 1980 indicate that water temperatures in Rock and Mill creeks may reach 18-21°C (64.4-69.8°F) between late spring and early fall (Winzler and Kelley 1980). The highest temperatures were recorded in lower Mill Creek and lower Rock Creek.

Stimson began collecting summer stream temperature data on the property in 1994. Peak summer water temperatures in 1996 ranged from 16.2°C (61.2°F) in the headwaters of Terwar Creek to 24.4°C (75.9°F) in lower Rock Creek. Maximum temperatures were usually recorded in the late afternoon and persisted for only a short time, with most reaches exhibiting a diurnal warming and cooling.

Pools in West Branch Mill Creek shaded by riparian vegetation.

Water temperatures were also measured outside the property boundary at the mouth of Mill Creek near Stout Grove and the Mill Creek campground in July and August 2000, and between June and October 2001 (V. Ozaki, pers. comm., 2002). Minimum and maximum temperatures recorded at the mouth of Mill Creek were 10.17°C and 19.42°C (50.3°F and 67.0°F), respectively, and 10.79°C and 17.03°C (51.4°F and 62.7°F) at the Campground site. Diurnal changes ranged about from below 0.5 °C to 4.2 °C (0.9°F to 7.56°F).

The Maximum Weekly Average Temperature (MWAT) has been suggested for use as a criterion for assessing impacts on juvenile fish (Armour 1991, CDF 1997). MWAT thresholds are used as a measure of the thermal tolerance of fishes based on their preferred temperature range and upper lethal limits. MWAT is the mathematical mean of multiple, equally spaced, daily temperatures over a seven-day consecutive period. MWAT was calculated for various locations and watercourses on the Mill Creek property (Table 2-3). For coho salmon, the temperature criterion based on MWAT has been calculated to range from 16.8°C to 17.4°C (62.2°F to 63.3°F) (NMFS 1997). CDF (1997) has proposed using 17.1°C (62.8°F) as the temperature criterion for specifying canopy retention standards in managed riparian zones in California. Although summer stream temperatures in the Mill Creek property may exceed the range of temperatures considered optimal for salmonids, maximum weekly average temperatures are well below lethal thresholds (Stimson Lumber Company 1998). Stream temperatures within the Mill Creek property, stream temperatures during the fall and winter are generally cool and not considered a problem for fish migration, spawning, or incubation (Stimson Lumber Company 1998). Summer temperatures may be a concern for juvenile steelhead, coho salmon, and cutthroat trout. Most juvenile chinook salmon have already migrated downstream by late spring.

Table 2-3. Mean weekly average temperature (MWAT) for streams within and adjacent to the Mill Creek property. Temperature data were collected in 1996 for sites within the property and in 2000 and 2002 for sites adjacent to the property.

LOCATION	MWAT[1]	
	°C	°F
Upper East Fork Mill Creek	14.7	58.5
Lower West Branch Mill Creek	16.5	61.7
Upper West Branch Mill Creek	13.8	56.8
Mouth of Mill Creek[2]		
2000	17.22	63.0
2001	18.11	64.6
Mill Creek Campground[2]		
2000	14.75	58.55
2001	14.40	57.92
Lower Rock Creek	18.8	65.9
Upper Rock Creek	16.7	62.1
Terwar Creek	15.4	59.8

1 Howard and Albro 1995a, 1995b

2 Mouth of Mill Creek and Mill Creek Campground (both located outside the Mill Creek property (V. Ozaki., pers. comm., 2002

Forest management can increase stream temperatures through removing or reducing riparian vegetation and canopy cover (Stimson Lumber Company1998). Stimson Lumber Company estimated canopy closure within riparian zones during July and August using a spherical densiometer. Rock Creek was found to be moderately shaded by streamside vegetation, with an average canopy closure of 65%. Streams within the Mill Creek drainage were found to be well-shaded with canopy closure ranging from 62 to 100% (Stimson Lumber Company 1998).

2.7.2 Dissolved oxygen

Dissolved oxygen (DO) concentrations generally remain near saturation in both Rock and Mill creeks year-round, except during the summer low-flow period (Stimson Lumber Company 1998). Winzler and Kelly (1980) reported that DO concentrations decreased to between 8 and 9 mg/L when temperatures increased and streamflows dropped. A lower limit of 5 to 7 mg/L is required to protect juvenile salmonids (Reiser and Bjornn 1979). Even during seasonally critical periods, dissolved oxygen concentrations in Mill Creek appear to remain above the 7 mg/L threshold established as a specific water quality objective for streams in the Smith River hydrological unit (NCRWQCB 1996).

2.7.3 Suspended sediment and turbidity

The following summarizes Winzler and Kelly's (1980) results of sampling average annual suspended sediment concentrations from 1973 to 1980. Stations were sampled in Rock Creek above and below logging operations, and data were averaged by site for each year. Average suspended sediment concentrations ranged from 0.1 to 74.4 mg/L upstream of logging operations, and from 2.5 to 142.3 mg/L downstream. Four sampling stations were installed in East Fork Mill Creek, one in the West Branch Mill Creek, and one downstream of their confluence in mainstem Mill Creek. Sediment concentrations in East Fork Mill Creek ranged from 1.1 to 37.6 mg/L, in West Branch Mill Creek from 1.4 to 15.3 mg/L, and in mainstem Mill Creek from 3.8 to 40.9 mg/L. A strong correlation between rainfall and suspended sediment values was noted. Although no numeric criteria for turbidity and suspended sediment have been specified in the Water Quality Control Plan for the North Coast region, concentrations recorded in both Rock and Mill creeks were below thresholds thought to adversely affect the migration and rearing of anadromous salmonids (Bjornn and Reiser 1991).

2.8 Vegetation

2.8.1 Plant communities

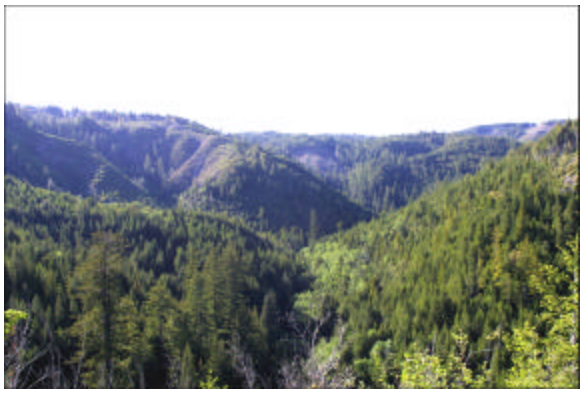
At least 15 vegetation series (Sawyer and Keeler-Wolf 1995) occur on the Mill Creek property (SHN 2000). Vascular plant species diversity is high with possibly over 300 species present. The following tree-dominated vegetation series are found on the property (listed in the order of their abundance): Redwood, Red Alder, Western White Pine, Knobcone Pine, Sitka Spruce, and Jeffrey Pine. Herbaceous-plant dominated series on the property include Bulrush, Bulrush-Cattail, California Annual Grassland, Introduced Perennial Grass, and Pampas grass. Shrub-dominated series include the Blue Blossom and Huckleberry Oak series. Other series present include the Darlingtonia and Fen series.

Table 2-4 displays percentage of each planning watershed in various vegetation age-class groups.

Table 2-4. Area covered by vegetation age class groups within Mill Creek planning units. Age classes are based on Stimson Lumber Company definitions.

AGE CLASS[1]	AREA OF PLANNING WATERSHED [km^2]										
	East Fork Mill Creek	Mainstem Mill Creek	West Branch Mill Creek	Rock Creek	Bummer Lake Creek	Smith Plain	Upper Jordan	Upper Terwar	Upper Hunter Creek	Wilson Creek	Total [km^2] (%)
Brush	0.16	0.00	0.00	0.26	0.19	0.00	0.00	0.09	0.00	0.00	**0.7 (<1)**
Hardwood	0.58	0.70	1.06	3.48	0.00	0.07	0.07	0.20	0.02	0.00	**6.18 (6)**
Non-forest	0.00	0.28	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.44 (<1)**
Old-growth	0.40	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.49 (<1)**
Old-growth scattered	3.18	0.14	0.67	1.62	0.38	0.10	0.00	0.11	0.02	0.26	**6.48 (6)**
Poles	1.47	0.11	1.96	0.08	0.25	0.00	0.44	0.00	0.00	0.00	**4.31 (4)**
Poles scattered	1.85	0.10	1.58	0.30	0.61	0.00	0.00	0.00	0.00	0.84	**5.28 (5)**
Regenerated	11.78	8.03	12.22	22.06	6.58	0.001	0.16	1.79	0.96	4.07	**67.7 (66)**
Unknown	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	**0.03 (<1)**
Young growth	0.09	0.69	1.77	0.44	0.00	0.006	0.32	0.00	0.00	0.00	**3.3 (3)**
Young growth scattered	1.46	0.86	0.59	2.33	0.34	0.11	0.41	0.49	0.07	0.24	**6.9 (7)**
Total	**20.97**	**11**	**20.01**	**30.6**	**8.35**	**0.29**	**1.4**	**2.68**	**1.07**	**5.41**	**102 (100)**

2.8.2 Upland forests



Upland forest in a tributary to Rock Creek.

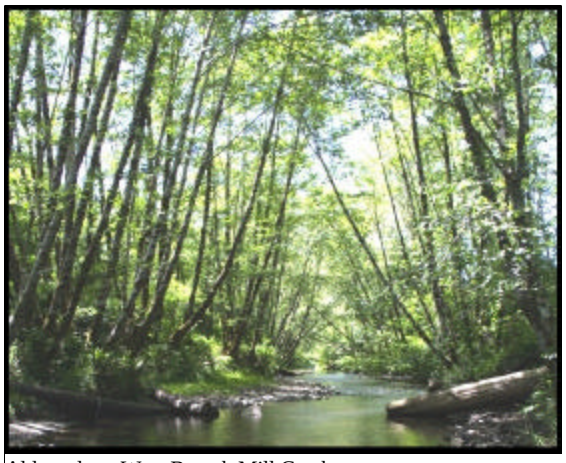
The coastal fog belt provides ideal conditions for fast-growing conifers such as coast redwood (*Sequoia sempervirens*). Douglas-fir (*Pseudotsuga menziesii*) is found in association with redwoods, and becomes more dominant in the eastern portion of the property where coastal influence is diminished. Sitka spruce (*Picea sitchensis*), grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), Port Orford cedar (*Chamaecyparis lawsoniana*), red alder (*Alnus rubra*), and tanoak (*Lithocarpus densiflorus*) are found as minor components of the coastal forest on the property.

As a result of past management, forest stands found across the property tend to be primarily even-aged, monospecific stands of various ages. Individual stands have sometimes regenerated at, or have been replanted at very high densities. Approximately 69% of the property supports stands of pole size or smaller trees (average dbh <28 cm [11 in]), while stands averaging >61 cm (24 in) dbh make up roughly 6%. Some stands likely have a much higher Douglas-fir component than was present before initial harvesting occurred.

2.8.3 Riparian areas

Stimson Lumber Company (1998) described the riparian vegetation conditions found on the property. The composition of riparian stands along fish-bearing streams on the property differs depending on whether the stands border high-gradient, confined channels or lower-gradient, less-confined channels. Riparian communities along high-gradient, confined channels are currently dominated by sapling or multi-layered stands <50 years old (Stimson Lumber Company 1998). Most stands along these channels consist of pole-size, second-growth trees, with trees >61 cm (24 in) dbh accounting for less than 25% of the canopy cover.

Hardwoods, particularly red alder and maple, are an important component of riparian stands along the lower-gradient, less-confined channels found on the property. Forty-nine percent of the riparian area along such channels currently consists of hardwoods, with most of these stands being >50 years of age. Riparian areas along large, unconfined channels are generally dominated by hardwoods because these trees quickly colonize gravel bars mobilized by large floods or channel avulsions. Most of the remaining riparian stands on the property are dominated by trees <28 cm (11 in) dbh and <30 years of age. Riparian stands along larger unconfined channels typically consist of predominantly pole-size trees with a few scattered large-diameter redwoods in the overstory.



Alders along West Branch Mill Creek.

The California Conservation Corps (CCC) had an agreement with Stimson Lumber Company to conduct riparian restoration. Over the past 5 years, the CCC has underplanted conifers in alder-dominated riparian areas adjacent to Mill Creek. Data on the cost, extent, and distribution of these plantings can be obtained from the offices of CDFG and CCC.

2.8.4 Special-status plants and vegetation types

Several rare and endangered plant species are present or can be potentially found on the Mill Creek property (Table 2-5). Two federally endangered species are potentially present: McDonald's rock cress (*Arabis macdonalidium*) (listed as rare under California state law) and Western lily (*Lilium occidentale*) (listed as endangered by California). Other species potentially present include 15 Category 1B species (plants that are rare, threatened, or endangered in California and elsewhere), 18 Category 2 species (plants that are rare, threatened, or endangered in California, but more common elsewhere), and 19 Category 4 species (plants of limited distribution; a watch list). It is mandatory that all Category 1B and 2 plants are considered when preparing an environmental document relating to CEQA, and it is strongly recommended by the California Native Plant Society (CNPS) that Category 4 plants be considered as well. Table 2-6 displays the status of plants found on the Mill Creek property.

Table 2-5. Rare and endangered plants, preferred habitat, and probability of occurrence within the Mill Creek property (Sources: Stimson Lumber Company 1998, PNB 1999, SHN 2000).

Scientific Name Common Name	Preferred Habitat	CNPS List[1]	Probability of Occurrence[2]	Listed in USGS Quad by CNPS[5]
Antennaria suffrutescens Evergreen everlasting	Serpentine rockfields and grasslands	4	L	
Arabis koehleri var. *stipitata* Koehler's stipitate rock cress	Jeffrey pine/grassland; open serpentine	1B	L	H
Arlenium trichomanes ssp. *trichomanes* Maidenhair spleenwort	Lower montane coniferous forest, rock	2	U	H
Arabis macdonaldiana McDonald's rock cress	Jeffrey pine/grassland, serpentine	FE, SR	L	
Arctostaphylos hispidula Howell's manzanita	Ultramafics in genl, knobcorne pine and scrub	2	P[3]	
Asarum marmoratum Marbled wild ginger	Ultramafics in genl, forest and scrub	2	P[3]	
Boschniakia hookeri Small groundcone	Mixed evergreen forest	2	L	
Cardamine nuttalii var. *gemmata* Yellow-tubered toothwort	Serpentine rockfields and grasslands	1B	L-M	
Carex leptalea Flaccid sedge	Wet marsh	2	L	CHM
Carex praticola Meadow sedge	Wet marsh	2	L	CC
Carex viridual var. *viridula* Green sedge	Wet marsh	2	NA	CC, SR
Castelleja miniata spp. elata Siskisyou Indian paintbruch	Darlingtonia fens, ultramafics	2	L	H
Darlingtonia californica California pitcherplant	Darlingtonia fens, ult ramafics	4	P[3]	
Dicentra formosa spp. *oregana* Oregon bleeding heart	Serpentine rockfields, grasslands, scrub	4	P[4]	
Epilobium oreganum Oregon fireweed	Ultramafics, Darlingtonia fens	1B	L	
Epilobium rigidum Siskiyou Mountains willowherb	Ultramafics, streamsides	4	M	
Erigeron cervinus Siskiyou daisy	Rock outcrops, streamsides	4	M	
Erythronium hendersonii Henderson's fawn lily	Lower montane coniferous forest	2	U	H
Erythronium howellii Howell's fawn lily	Lower montane forest, North Coast coniferous forest	1B	U	H
Gentiana setigera Mendocino gentian	Ultramafics, Darlingtonia fens	1B	L	
Horkelia sericata Howell's horeklia	Serpentine rockfields, grasslands, and scrub	4	H	
Lathyrus delnorticus Del Norte pea	Ultramafics, streamsides	4	H	
Lathyrus palustris Marsh pea	Coastal bogs, fens, marshes and swamps	2	U	CC, SR
Lewisia oppositifolia Opposite-leaved lewisia	Seasonally wet serpentine flats	2	L-M	H
Lilium bolanderi Bolander's lily	Serpentine rockfields, grasslands, scrub	4	P[4]	
Lilium occidentale Western lily	Coastal marsh, coastal terrace, Sitka spruce/reedgrass association	FE, SE	L	CC,SR
Lilium pardilinum spp. vollmeri Vollmer's lily	Ultramafics Darlingtonia fens, streamsides	4	P[3]	
Lilium rubenscens Redwood lily	Redwood and mixed evergreen scrub, forest	4	H	
Lilium washingtonianum Purple-flowered Washington lily	Mixed evergreen scrub, coniferous forests	4	P[3]	
Lomatium howellii	Serpentine rockfields, grasslands, scrub	4	H	

Scientific Name Common Name	Preferred Habitat	CNPS List[1]	Probability of Occurrence[2]	Listed in USGS Quad by CNPS[5]
Howell's lomatium				
Minuartia howellii Howell's sandwort	Lower montane coniferous forest	1B	U	H
Mitella caulescens Leafy-stemmed mitrewort	Lower montane coniferous forest	2	U	CH
Monotropa uniflora Indian-pipe	North Coast coniferous forest	2	U	CC, H, CH
Montia howellii Howell's monita	Wet forest openings, seasonally wet, compact soil	1B	L-M	
Pinguicula vulgaris spp. *macroceras* horned butterwort	Moist ultramafics, streamsides, wet rocks, Darlingtonia fens	2	M	CC, H
Pyrrocoma racemosa var. *congesta* Del Norte pyrrocoma	Lower montane forest, serpentine	2	U	H
Salix delnortensis Del Norte willow	Moist ultramafics, streamsides	4	M	
Sagittaria sanfordii Sanford's Arrowhead	Marshes and swamps	1B	L	CC
Sanguisorba officinalis Great burnet	Darlingtonia fens, costal marsh	2	H	
Sanicula peckiana Peck's sanicle	Serpentine rockfields, grasslands, scrub	4	H	
Saxifraga nuttallii Nuttall's saxifrage	North Coast coniferous forest	2	U	H
Sedum laxum spp. *flavidum* Pale yellow stonecrop	Rock outcrops, serpentine or other	4	L-M	
Sedum laxum spp. *heckneri* Heckner's stonecrop	Rock outcrops, serpentine or other	4	L-M	
Senecio bolanderi var. *bolanderi* Seacoast ragwort	Coastal shrub, North Coast coniferous forest	2	U	H
Senecio macounii Siskiyou Mountains ragwort	Serpentine rockfields, grasslands, scrub	4	M	
Sidalcea malachroides Maple-leaved checkerbloom	Disturbed roadsides, disturbed redwood forests	1B	L	CC, CH
Sidalcea malviflora spp. *patula* Siskiyou checkerbloom	Disturbed roadsides, moist meadows	1B	L	
Sidalcea oregana spp. *eximia* Coast cherckerbloom	Disturbed roadsides, moist meadows	1B	L	CC
Smilax jamesii English Peak greenbriar	Streamside, often ultramafics	1B	L	
Streptanthus howellii Howell's jewelflower	Serpentine rockfields, grasslands, scrub	1B	L	CC
Tauschi glauca Glaucous tauschia	Serpentine rockfields, grasslands, scrub	4	H	
Thermopsis robusta Robust false lupine	Open scrub, genl. disturbed	1B	L-M	
Vancouveria crysantha Siskiyou inside-out-flower	Serpentine rockfields, grasslands, scrub	4	P[3]	
Viola primulifolia spp. *occidentalis* Western bog violet	Darlingtonia fens	1B	L	H

[1] CNPS (= California Native Plant Society) plant categories:
1B = rare, threatened, or endangered in California and elsewhere
2 = rare, threatened, or endangered in California, but more common elsewhere
3 = plants about which more information is needed
4 = plants of limited distribution; a watch list
FE = federally endangered
SE = endangered under California State Law
SR = rare under California State law

[2] L = Low, H = High, M = Medium, P = Present, U=Unknown

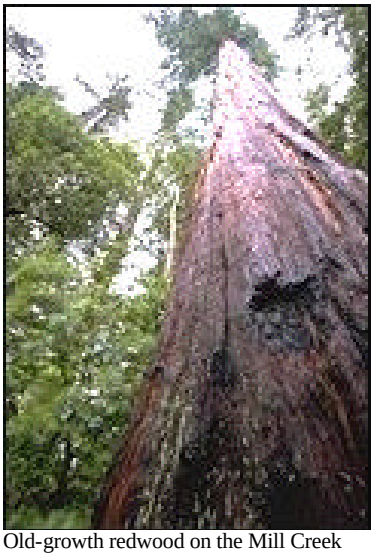
[3] SHN 2000

[4] PNB 1999

[5] USGS quads: CC = Crescent City, CH = Childs Hill, CHM = Canthook Mountain, SR = Sisters Rock, H = Hiouchi

Late-successional and old-growth forest

Late-successional forests are mature stands that have regenerated naturally on formerly logged sites, and are beginning to achieve old-growth characteristics. The term "old-growth forest" generally is reserved for forests that have never been logged and show little or no evidence of past human activity (Alverson et al. 1994). Frequently noted characteristics of old-growth forests include a deep, multi-layered canopy, a heterogenous mix of trees of different ages and sizes, abundant shade-tolerant species, numerous large, standing snags and downed logs in various size and decay classes, and abundant tree cavities (Franklin et al. 1981, Old-growth Definition Task Group 1986, Morrison 1988, Spies and Franklin 1988, Norse 1990). Redwoods may continue to grow vigorously for 2,000 years (Helms 1995). Franklin (1982, as cited in Sawyer et al. 2000) defined north coast California coniferous stands over 200 years old as old-growth; redwood stands are generally considered to be in early stages of old-growth at this age. The structural complexity of old-growth forest creates a variety of microhabitats that support a unique and diverse biota. Although old-growth forest has no specific legal status, it is of special interest because of the habitat it provides for many endangered and threatened plants and animals, and the aesthetic value it holds for many people.



Old-growth redwood on the Mill Creek property.

Very little old-growth forest remains on the property; of these stands, the redwood series is most common. Old-growth redwood stands on the property are often limited to narrow stringers along drainages or remnant individual trees. The largest remaining old-growth stand ("Paragon") covers approximately 36 ha (90 ac), and is located in the central portion of the property. Another intact 6-ha (14-ac) stand ("Hamilton Buffer") is located south of the company offices. "George's Saddle" is a 12-ha (29-ac) stand located in the southern part of the property.

Serpentine habitat

Serpentine soils are characterized by low levels of nutrients and typically have high concentrations of heavy metals, including chromium, cobalt, and nickel (MDNR 2002, McCarten 2002). They are highly erodible due to their mineralogical composition. Plant communities associated with serpentine soils are often highly unique. Serpentine habitats include barrens, grasslands, chaparral vegetation, and some relatively uncommon forest stands dominated by species such as Jeffrey pine and western white pine. Large patches of serpentine habitat are present on the Mill Creek property, primarily along its eastern boundary (K. Stowe, pers. comm., 2002).

Tree species of special interest

Tree species of particular interest found within the study area include knobcone pine (*Pinus attenuata*), Port Orford cedar (POC), western white pine (*Pinus monticola*), and Jeffrey pine (*Pinus jeffreyi*). Knobcone pine is a serotinous (fire-adapted) species that can be a climax species on poor soils or an early successional species in redwood and Douglas-fir (SHN 2000). Knobcone pine of various ages is abundant in old harvest areas, due to the extensive timber management and broadcast burning. Recently harvested and burned plantations on the property are characterized by an abundance of regenerating knobcone pines. Such reproduction is unusual within the species' range due to past fire suppression and absence of timber management in knobcone pine stands in general (SHN 2000).

The second tree species of special interest is the Port Orford cedar, which occurs throughout the property. POC generally occupies coastal ranges in a 40-km (25-mi) wide zone extending from Reedsport, Oregon south to central Humboldt County (D. Imper, pers. comm., 2002). POC is generally uncommon across its range, although it is locally abundant in some areas of the property. This species is suffering substantial mortality due to an exotic, fatal root disease called Port Orford Cedar root disease (*Phytophthora lateralis*)

that is spreading rapidly throughout its range. Although the disease is common in the nearby South Fork of the Smith River drainage and the Smith River National Recreation Area, until recently there had been no indication that the disease was present within the Mill Creek property (SHN 2000). In fact, the Mill Creek watershed had been reported to be one of the few unaffected watersheds in Del Norte County. Lack of the disease was probably due to the absence of through traffic and the relatively isolated watersheds. In addition, Stimson did not use heavy equipment brought from off-site, which decreased the potential for the disease to be introduced from other areas. Recently, evidence of the root disease was identified at two locations in upper Bummer Lake Creek on the property (V. Gizinski, pers. comm., 2002). Small seedlings and saplings showed signs of infection, which have yet to be confirmed as POC root disease (V. Gizinski, pers. comm., 2002).

A third tree of interest is the Jeffrey pine, which occurs on serpentine and periodite soils and under environmentally harsh conditions (Waldorf and Catanese-Palacios 2002). This pine has a deep root system. The rare Koehler's stipitate rock cress (*Arabis koehleri var. stipitata*) and the federally endangered McDonald's rock cress may occur in association with this species. Within the Mill Creek property, the Jeffrey pine series is only found in a small area in the northeast corner of the property (SHN 2000).

The Mill Creek property also features some unique old-growth stands of Pacific madrone (*Arbutus menziesii*) and western white pine. Both species prefer well drained soils, such as rocky or sandy substrates. These species grow well in open spaces, and especially madrone requires periodic fire events to eliminate conifer overstory.

Darlingtonia fens

Darlingtonia fen on the Mill Creek property.

At least two Darlingtonia fens occur east of Childs Hill on ultramafic soils (SHN 2000). One fen is approximately 12 by 24 m (40 ft by 80 ft) and dominated by California pitcherplant (*Darlingtonia californica*), Labrador-tea (*Ledum glandulosum*), Sitka alder (*Alnus viridus* var. *sinuata*), salal (*Gaultheria shallon*), slough sedge (*Carex obnupta*), and western azalea (*Rhododendron occidentale*). In addition, a small population of the relatively rare Vollmer's lily (*Lilium pardilinum* spp. *vollmeri*) is located on the site. Darlingtonia fens are often associated with other sensitive plant species (SHN 2000). A second fen was documented by Stimson personnel on the lower slope of Rattlesnake Mountain. More fens may be present on the east slope of Childs Hill, in the northeast portion of the property and on the west slope of Rattlesnake Mountain (D. Imper, pers. comm., 2002). Timber harvest practices may have enhanced physical characteristics of the substrate favored by the California pitcherplant and associates species, as the elimination of trees decreased evapotransporation and increased soil moisture. The removal of overstory, however, also increased the growth of vegetation not associated with the Darlingtonia fens that might be encroaching into this vegetation series.

Fen series

The Fen series is similar to the Darlingtonia Fen series, except that California pitcherplant and a few other species are absent. Fen series occur in a few areas on the property. One site is approximately 12 m by 70 m (40 ft by 70 ft) and dominated by Nootka reedgrass (*Calamagrostis nutkaensis*), Sitka alder, deer fern (*Blechnum spicant*), Labrador tea, salal, bog St. John's wort (*Hypericum anagalloides*), and peat moss (*Sphagnum* spp.) (SHN 2000). Similar fens are exceedingly rare in northern California, making this fen

significant, especially due to its similarity to a fen located in the Crescent City Marsh Wildlife Area, approximately 1.5 miles to the north, which supports the largest known population of the federally endangered western lily (Imper and Sawyer 1992). Thus, the fen series on the Mill Creek property provides a transitional stage between the coastal habitat of the western lily, and the more inland Darlingtonia fens. Additional representatives or species at the southern limits to their distributions (such as sweet grass [*Hierochloe odorata*] and great burnet [*Sanguisorba officinalis*]) could be present in the east half of the Mill Creek property.

Tanoak
Some previously logged areas on the property may have a higher component of tanoak than existed prior to commercial logging activities. Tanoak tends to dominate previously logged stands because of the long timeframes required for conifers like Douglas-fir and redwood to outcompete this hardwood species. In northern California, tanoak is one of the primary successional species after timber harvesting or natural disturbances such as fire and windthrow. Tanoaks regenerate by sprouting and Douglas-fir by seeding (Mayer and Laudenslayer 1988). Because Douglas-fir seed years are irregular and tanoak sprouts grow faster than Douglas-fir seedlings and coast redwoods (Mayer and Laudenslayer 1988), tanoak may aggressively compete with Douglas-fir, as well as coast redwood, in mixed coniferous forests (Barrett 1995; Burns 1983; Little 1979; all as cited in Piirto et al. 1997). Tanoak may form a nearly solid canopy for 60 to 100 years until natural mortality allows Douglas-fir to eventually outcompete most tanoak and become dominant (Mayer and Laudenslayer 1988). The high stem densities in these stands may suppress growth of other trees and make these stands vulnerable to catastrophic fires, especially in the vicinity of ridge-crests, which may be prone to lightning strike ignition.

Exotic species
The number of exotic plant species on the property is reported to be relatively low, even though the majority of the property has been logged (SHN 2000). Except for pampas grass (*Cortaderia jubata*), the abundance of other exotic species appears low, in part due to the presence of ultramafic-influenced soils within the property, as well as the isolation of the property from potential sources of invasion by National Park lands (SHN 2000) and access by public who can introduce and transfer exotics.

2.8.5 Plant pathogen and pests

Forest insects, fungi, and pathogens are important factors influencing forest ecosystem stability and productivity (Bormann and Likens 1979, Edmonds 1982, Swank and Crossley 1987, as cited in Schowalter et al. 1997). These organisms can increase primary productivity through pruning, thinning, and stimulating nutrient cycling (Mattson and Addy 1975, Wickman 1980, and Alfaro and Shepard 1991, as cited in Schowalter et al. 1997). Changes in stand characteristics caused by pathogens and insects usually occur slowly, with a few exceptions such as some bark beetle outbreaks (Schowalter et al. 1997). Outbreaks of any of these organisms may occur occasionally but do not pose a threat to forests in general (Schowalter et al. 1997). Epidemic outbreaks in many forests are predicted to increase due to the effects of industrial timber harvest (e.g., monotypic, even-aged management and fire suppression) and the effects of these practices (e.g., overcrowding). These effects may be exacerbated by climatic changes (Schowalter et al. 1997).

Several plant pathogens and pests present potential risks to forests on the Mill Creek property. The greatest threat to forests is the spread of introduced species, such as Sudden oak death (*Phythophthora ramorum*) and Port Orford cedar root disease. Native trees can coexist with native pathogens and insects, but have low resistance to these introduced species (Schowalter et al. 1997).

Plant pathogens affecting conifers

Redwood
Several pathogens and insects may infect redwoods, including flat headed twig borer and girdler (Anthaxia amogaster), Redwood beetle (*Phloesinus sequoia* and *P. cristatus*), and Sequoia pitch moth (*Vespamima sequoia*). Large outbreaks, however, are uncommon. There are currently no known pathogens that kill redwoods past the seedling stage (Sawyer et al. 2000).

Douglas-fir
Douglas-fir stands are affected by several different pathogens and pests, including Rhabdocline needlecast (*Rhabdocline pseudotsugae* and *R. weirii*), Twig blight (*Diplodia* spp.), Douglas-fir Tussock moth (*Orgyia pseudotsugata*), Western spruce budworm (*Choristoneura occidentalis*), and Douglas-fir beetle (*Dendroctonus pseudotsugae*). Several insects, including the Douglas-fir tussock moth and the western spruce budworm, are known to heavily defoliate forest stands, sometimes over several years. Current management practices such as thinning and uneven-aged management, however, can prevent large outbreaks (Schowalter et al. 1997). The Douglas-fir beetle is the most important beetle affecting Douglas-fir stands (Bugwood 2001). Outbreaks occur sporadically but are usually severe, especially after episodes of windthrow or fire, and are usually of a short duration in inland forest stands. Coastal Douglas-firs are more resistant due to the higher moisture content in soil and air, which prevents wood from drying and does not allow beetles to thrive in the green or moist wood.

Port Orford cedar
The introduced fungus *Phytophthora lateralis* is the most serious disease affecting Port Orford cedar. Other species of *Chamaecyparis* are less susceptible than Port Orford cedar, and trees of other genera are not affected. First symptoms include darkening of rootlets, disintegration of fine roots, and discoloration of the inner bark and cambium of larger roots to a deep cinnamon brown. The disease spreads up the trunk to a distance of twice the stem diameter. Further spread is limited as the crown dies. The foliage withers, turns bronze, and finally, light brown with discoloration occurring throughout the crown. Infected trees are increasingly susceptible to secondary infections by other pathogens and pests such as bark beetles, which speed death and may modify foliage discoloration by altering the rate of drying. Recently killed trees are pre-disposed to windthrow. POC root rot is dispersed by transport of contaminated plant parts, soil, and sediments by natural vectors such as streams; as well as vectors related to human use, such as pedestrians, vehicles, mountain bikes, and horses. POC root rot has been found throughout the range of Port Orford cedars.

Plant pathogens affecting hardwoods

Several pathogens and pests infect hardwood trees. Oaks are infected by bark beetles including the whitemarked Tussock moth (*Hemerocampa leucostigma*) and the red oak borer (*Enphalodes rufulus*). Pathogens infecting hardwoods include fungi causing for example Anthracnose in oaks and dogwood, *Hypoxylon* spp., a canker disease, and *Ceratocystis fagacearum*, an oak wilt. The greatest threat to hardwoods is currently Sudden Oak death (SOD).

Sudden Oak death (SOD)
The plant pathogen with the greatest potential impact to forests in the Pacific Northwest is Sudden Oak death. This introduced fungus is distinct from the other 60 species of *Phytophthora* found worldwide. There are at least two classes of hosts for *P. ramorum*: (1) bark canker hosts that become infected on the trunks and (2) foliar hosts that become infected on leaves and small branches (Marin County UCCE 2002). Bark cankers generally lead to mortality in tanoak, coast live oak (*Quercus agrifolia*), California black oak (*Quercus kelloggii*), and Shreve oak (*Quercus parvula* var. *shrevei*). Foliar hosts die only occasionally and include bay laurel (*Umbellularia californica*), rhododendrons (*Rhododendron* spp.), bigleaf maple (*Acer*

macrophyllum), huckleberry (*Vaccinium* spp.), madrone, mazanita (*Arctostaphylos* spp.), California coffeeberry (*Rhamnus californica),* toyon (*Heteromeles arbutifolia*), honeysuckle (*Lonicera hispidula*), California buckeye (*Aesculus californica*) (COMFT 2001). *SOD* is dispersed by transport of contaminated plant parts, soil, and sediments by natural vectors such as streams; as well as vectors related to human use, such as pedestrians, vehicles, mountain bikes, and horses. SOD is documented in portions of Mendocino, Humboldt, Contra Costa, Marin, Sonoma, Napa, San Mateo, Santa Clara, Santa Cruz, and Monterey counties. SOD has recently been detected in Curry County, Oregon. All oaks have similar symptoms following infection by *P. ramorum.* The first symptom is bleeding. Crowns can thin or change color completely within a few weeks. In the later stages of infection, weakened disease trees may show symptoms of secondary infection by bark beetles and other fungi.

2.9 Fish

2.9.1 Fish species and status

Streams within and downstream of the Mill Creek property support both anadromous and resident fish populations (Table 2-6). Anadromous salmonids known to occur in Mill Creek include coho salmon (*Oncorhynchus kisutch*), fall chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), steelhead (*O. mykiss irideus*), and coastal cutthroat trout (*O. clarki clarki).* Coho salmon are federally listed as threatened (NMFS 1997) and are currently the only listed fish species found in the Mill Creek watershed. This species is discussed in detail in Section 2.9.2.

Other fish species that have been reported from streams on the Mill Creek property include western brook lamprey (*Lampetra richardsoni*), river lamprey (*Lampetra ayresi*), Pacific lamprey (*Lampetra tridentate*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*), threespine stickleback (*Gasterosteus aculeatus*), Klamath smallscale sucker (*Catostomus rimiculus*) (Albro and Gray 2002), and American shad (*Alosa sapidissima*). Tidewater gobies and longfin smelt are likely present in the Smith River estuary, but are brackish or saltwater species that are not expected to occur on freshwater streams on the property.

Introduced fish species such as largemouth bass (*Micropterus salmoides*), black bass (*Micropterus* spp.), sunfish (*Lepomis* spp.), and catfish (Ictaluridae) were previously introduced into the 4.6-acre-foot reservoir, located to the north west of the Forestry Center (K. Stowe, pers. comm., 2002). Largemouth bass is still known to occur and the others may still be present.

Table 2-6. Status of fish species occurring or potentially occurring in the Mill Creek watershed

SPECIES	ESU	STATUS [1]	
		Federal	State
Coho salmon *Oncorhynchus kisutch*	Southern Oregon/Northern California Coasts	T	CE
Chinook salmon *Oncorhynchus tshawytscha*	Southern Oregon and Northern California Coastal	NW	CSC
Steelhead *Oncorhynchus mykiss irideus*	Klamath Mountains Province	NW	None
Coastal cutthroat trout *Oncorhynchus clarki clarki*	Southern Oregon/California Coastal	NW	CSC
Chum salmon *Oncorhynchus keta*	Pacific Coast	NW	None
Green sturgeon *Acipenser medirostris*	N/A	C2	None
River lamprey *Lampetra ayresi*	N/A	C2	CSC
Pacific lamprey *Lampetra tridentata*	N/A	C2	None

[1]
T Threatened
NW Not warranted for listing
CSC California Department of Fish and Game and/or California Board of Forestry Species of Concern
C2 Species formerly classified as Category 2 candidates by the USFWS; these species no longer have a legal federal status
CE candidate to be listed as endangered pursuant to the California Endangered Species Act.

2.9.2 Anadromous salmonids

Coho salmon

Coho salmon in the Mill Creek watershed belong to the Southern Oregon/Northern California Coasts Evolutionarily Significant Unit (ESU), which was listed as federally threatened in 1997. This ESU includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon and Punta Gorda, California. NMFS is currently conducting a status review of this and 24 other salmon and steelhead ESUs (NMFS 2002). Critical habitat was designated in 1999 (NMFS 1999); however, NOAA is currently seeking judicial approval to withdraw critical habitat designations for 19 salmon and steelhead populations, including this ESU (NOAA 2002). Designated critical habitat currently encompasses the water, substrate, and adjacent riparian zone of all accessible estuary habitat and river reaches between Cape Blanco, Oregon, and Punta Gorda, California. California Department of Fish and Game considers coho salmon a candidate for listing as endangered pursuant to the California Endangered Species Act.

Coho salmon are found in most major tributaries to Mill Creek on the property (a map of coho distribution is included in Stimson Lumber Company 1998, p. 4-43). There are approximately 19 km (11.8 mi) of known coho salmon spawning and rearing habitat within the Mill Creek basin. No adult or juvenile coho salmon have been observed in annual surveys conducted since 1993 in Rock Creek (Howard and Albro 1995b, 1997a, 1997b); however, one juvenile coho was observed near the mouth of Rock Creek in 1995 (Smith River Advisory Council 2002). The physical characteristics of the Rock Creek system, which has a high gradient and coarse substrate, are believed to be unfavorable for coho salmon.

Within the Mill Creek property, coho salmon spawning is scattered, with most fish spawning in upper West Branch Mill Creek and Kelly Creek (a tributary of East Fork Mill Creek). Spawning of coho has also been observed in East Fork Mill Creek, Bummer Lake Creek, and Low Divide Creek (Howard and Albro 1995a, 1997a). Kelley and West Branch Mill creeks contain good spawning gravels for coho salmon and are characterized as having a moderate pool/riffle ratio with LWD accumulations that provide suitable summer and winter rearing habitat (Howard and Albro 1995a, 1997a). Spawning habitat in the other tributaries is marginal due to coarse substrate size and high water velocities, and is confined to small pockets of gravel and cobble (Howard and Albro 1995a, 1997a).

Coho salmon have a less variable life history than other anadromous salmonids. Most return to spawn at age 3+ and enter the rivers during late-fall and winter. Eggs mature after 1.5 to 4 months incubation, depending on temperature. Juveniles rear in fresh water for up to 15 months before outmigrating to the ocean. Prior to returning to spawn as adults, coho generally spend 16 months feeding and growing in the ocean (Sandercock 1991). Some males (often called "jacks") mature earlier and return after only a few months in the ocean. Bell (2001) has documented that some juvenile coho salmon in northern California (Prairie Creek, Humboldt County) may rear in fresh water for two winters before migrating to sea.

Adult coho salmon escapement has been monitored since 1980 in West Branch Mill Creek and since 1993 in other areas of the Mill Creek basin. Approximately 16 km (10 mi) of known anadromous spawning habitat in both West Branch Mill Creek and East Fork Mill Creek and its tributaries are surveyed. Numbers of adult coho salmon observed in West Branch Mill Creek have ranged from a high of 114 in 1993-1994 to a low of 3 in 1998. Numbers of adult coho salmon observed in East Fork Mill Creek have ranged from a high of 45 in 1994-1995 to a low of 1 in 1998-1999. Coho numbers appear to have declined over the years in both the East Fork and West Branch of Mill Creek (Howard 1999). Redd counts conducted during the same period in the two branches have ranged from a high of 68 in 1996-1997 to a low of 1 in 1998-1999 (Howard 1999).

Juvenile salmonid outmigrant trapping in the Mill Creek drainage has been used to collect information on coho salmon outmigration timing, relative abundance, and overwinter survival from 1994 to 2000 in the East Fork and West Branch of Mill Creek (Howard and Albro 1997b). Downstream movement of both smolt and young-of-the-year (YOY) coho salmon has been observed, suggesting that both extended rearing and seasonal downstream dispersal of coho salmon occur within the Mill Creek drainage. Outmigrating coho smolts have been collected in the traps from late February through May, with most movement occurring from mid-April to mid-May, and some movement possibly extending into June (Albro and Gray 2002). Overwinter survival estimates indicate that 34% to 48% of the coho salmon present during the summer survive to outmigrate the following year (Howard and Albro 1997b).

Stimson Lumber Company has monitored salmonid outmigration with outmigrant traps located on the West Branch and East Fork of Mill Creek since 1994. Results of outmigrant trapping for coho salmon are shown in Table 2-7. Figure 2-2 displays smolt production from Mill Creek in relation to streams in Oregon and California. It should be noted that the statistical methods used to estimate production were not consistent between these streams, and the years in which data were collected are not the same.

Table 2-7. Number of coho salmon smolts captured in outmigrant traps on Mill Creek as estimated using a bootstrap calculation (Stimson Lumber Company 1998).

	1994	1995	1996	1997	1998	1999	2000	Average
West Branch Mill Creek	832	2717	1117	1261	5554	1580	2265	2189
East Fork Mill Creek	1224	932	1131	350	2332	259	2000	1175
Total	2056	3649	2248	1611	7886	1839	4265	3365

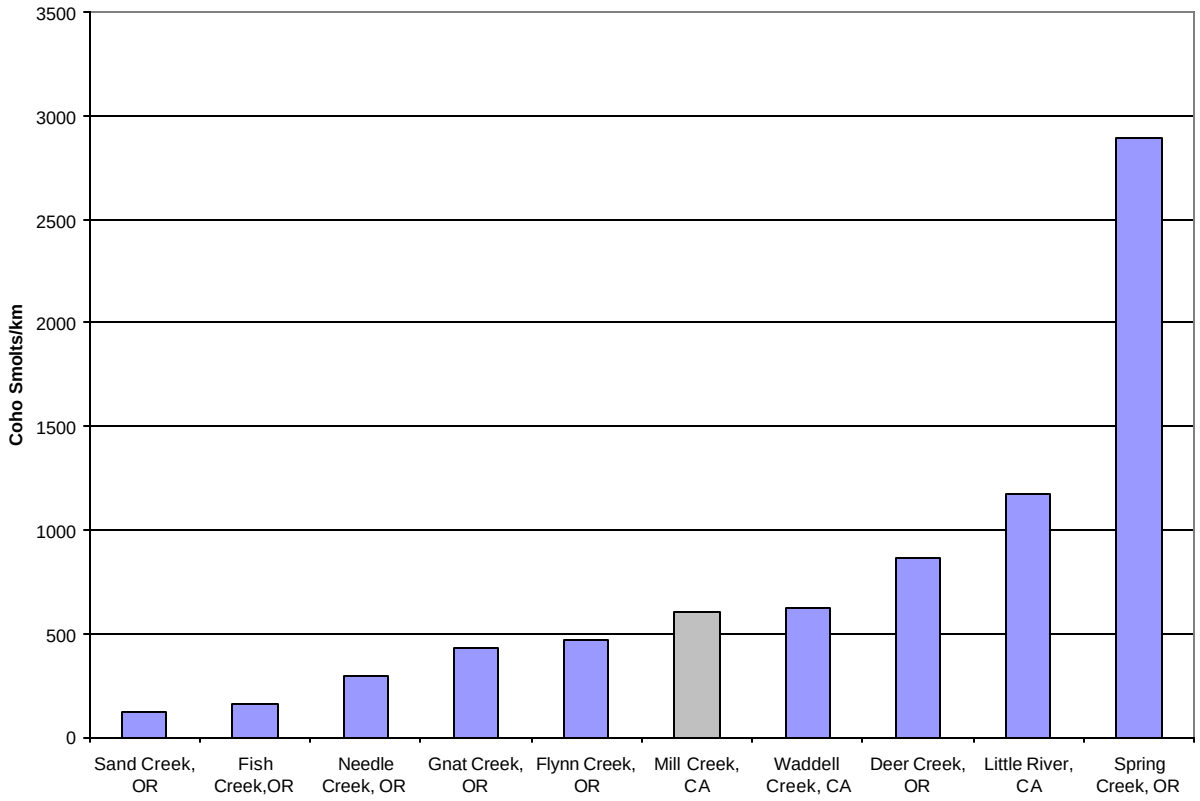


Figure 2-2 **Coho smolt production from Oregon and California streams. Data from Oregon streams and Waddell Creek are from Bradford et al. (1997), Mill Creek data are from Albro and Gray (2002), Little River data are from Matt House (Simpson Timber Company, unpubl. data). It should be noted that the statistical methods used to estimate production were not consistent between these streams, and the years in which data were collected are not the same.**

Chinook salmon

Chinook salmon in the Mill Creek watershed are fall-run fish that belong to the Southern Oregon and Northern California Coastal ESU. This ESU was found not warranted for listing as federally threatened or endangered by NMFS in September 1999. Fall chinook spawn in Mill Creek between November and February/March (Waldvogel 1988). Fry emerge in early winter after 30-90 days of incubation. Juveniles remain in fresh water for 3-6 months prior to outmigration (Meehan and Bjornn 1991). Juveniles rear in estuaries until they move into the marine environment following smoltification.


Chinook fry.

Chinook salmon spawn and rear in both Mill and Rock creeks (Stimson Lumber Company 1998). There is approximately 19 km (11.8 mi) of known chinook salmon spawning and rearing habitat within the Mill Creek basin. The East Fork and West Branch of Mill Creek and their tributaries are used extensively by chinook salmon as both spawning and rearing habitat. Most chinook salmon spawn in the lowermost 7 km (4.5 mi) of West Branch Mill Creek. The Rock Creek drainage contains approximately 7 km (4.5 mi) of chinook spawning and rearing habitat (Howard and Albro 1995b, 1997a, 1997b). Spawning and rearing habitat in the Rock Creek drainage is reportedly confined to small pockets and a short section of low-gradient channel in the upper headwaters.

Due to their larger size, chinook salmon are able to construct redds in coarser substrates than other anadromous and resident salmonids. Spawning surveys have been conducted on a 2.7-km (1.7-mi) reach of the lower West Branch Mill Creek drainage by the University of California Cooperative Extension since 1980 (Waldvogel 1985, 1988). Numbers of chinook salmon spawners observed during these surveys ranged from a low of 31 in 1990 and a high of 361 in 2001 (Waldvogel 2002) (Figure 2-3). Escapement surveys have also been conducted by Stimson Lumber Company since 1993 in the Mill and Rock creek drainages. Numbers of adult chinook salmon observed in the East Fork and West Branch of Mill Creek (both of which are used extensively by chinook salmon) ranged from a low of 133 spawners in 1993-1994 to a high of 360 in 1998-1999. Numbers of adult chinook salmon observed in Rock Creek ranged from a low of 11 in 1998-1999 to a high of 35 in 1996-1997 (Howard 1999).

Juvenile salmonid outmigrant trapping began on the West Branch and East Fork of Mill Creek in 1994. Only YOY chinook have been captured, indicating that extended rearing is uncommon in the Mill Creek basin. Juvenile chinook salmon outmigration generally peaks in early April, and most fish have usually left the system by late July (Albro and Gray 2002). Since 1994, numbers of juvenile chinook captured in outmigrant traps have ranged from a high of 48,917 in 1997 to a low of 7,589 in 1994, with 21,401 juveniles captured in 2000 (Albro and Gray 2002). The majority of chinook salmon captured during outmigrant trapping were captured in West Branch Mill Creek (Stimson Lumber Company 1998).

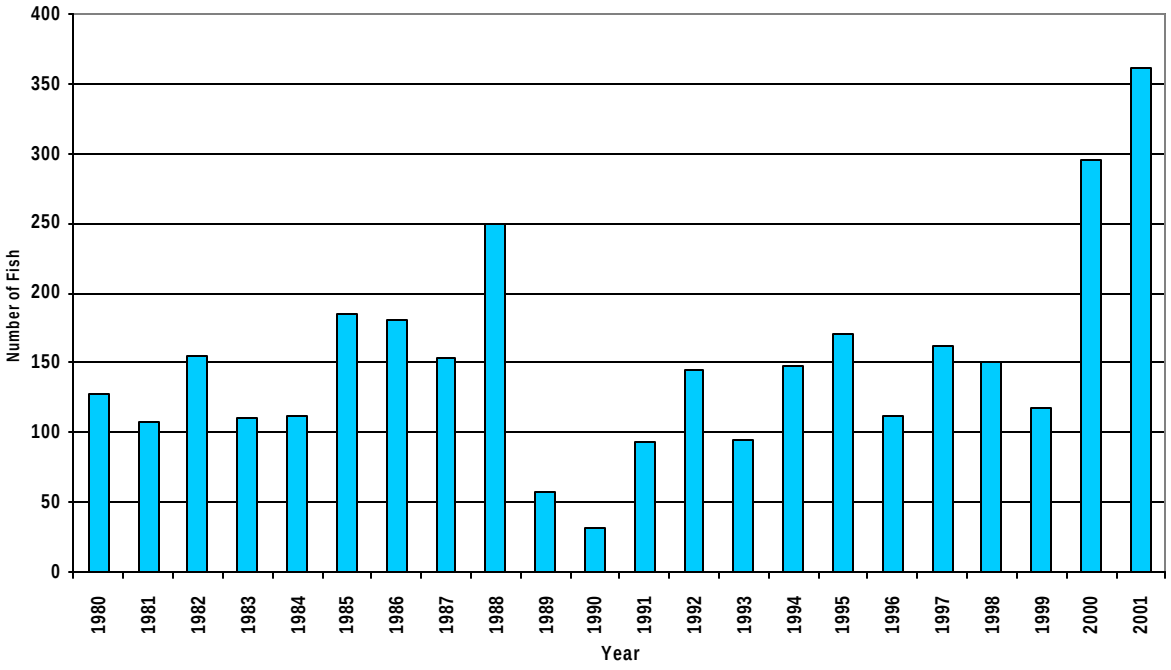


Figure 2-3. Minimum annual chinook salmon escapement in the West Branch of Mill Creek (J. Waldvogel, unpublished data)

Steelhead

Steelhead in the Mill Creek watershed belong to the Klamath Mountains Province ESU. This ESU was found not warranted for listing as federally threatened or endangered by NMFS in September 1999. Steelhead found in the Smith River drainage, including Mill Creek, are winter-run steelhead. Winter steelhead may enter fresh water as early as autumn, but usually return later in the season than other anadromous salmonids. Steelhead are capable of sustaining higher swimming and burst speeds than other salmonids, enabling them to ascend high-gradient reaches, waterfalls, and cascades that may act as barriers to other species. As a result, steelhead often spawn in upper headwater reaches that may not be accessible to other anadromous salmonids.

Steelhead escapement in Mill Creek basin has not been monitored. Steelhead are difficult to observe and count when returning to spawn, as they return over a longer period of time than other salmonids. In addition, they do not always die after spawning, which makes carcass counts impractical as a tool for estimating escapement (Howard 1999).

Juvenile salmonid outmigrant trapping began on the Mill Creek property in 1994. Steelhead smolts have consistently appeared during the first few weeks of trapping and are frequently the first salmonid smolts to appear in the traps. Smolts are typically captured in the traps from late February through early May (Albro and Gray 2002). All juvenile life stages of steelhead from fry to smolt have been observed in the outmigrant traps, indicating that extended freshwater rearing occurs in the basin. Because juvenile steelhead and coastal cutthroat trout are difficult to distinguish from one another, numbers of juvenile steelhead captured may include some cutthroat trout. Numbers of steelhead smolts captured in the

outmigrant traps has ranged from a low of 57 in 1995 in West Branch Mill Creek and 43 in 1993 in the East Fork Mill Creek, to a high of 1,112 in the West Branch Mill Creek and 606 in the East Fork Mill Creek in 2000. Post-spawning adult steelhead ("kelts") have also been captured in the outmigrant traps. Numbers of kelts has ranged from a low of 8 in 1995 in the West Branch Mill Creek and 25 in 1999 in East Fork Mill Creek, to a high of 82 in 1997 in the West Branch Mill Creek and 103 in 1997 in the East Fork Mill Creek (Albro and Gray 2002).

Coastal cutthroat trout


Cutthroat trout .

Coastal cutthroat trout in the Mill Creek watershed belong to the Southern Oregon/California Coastal ESU. This ESU was determined to be not warranted for listing as federally threatened or endangered by NMFS in April 1999. Although some coastal cutthroat trout may be anadromous, protection of the species is under the jurisdiction of the U. S. Fish and Wildlife Service (USFWS). Cutthroat trout belong to the same genus as other Pacific salmon and steelhead, but are generally smaller, rarely overwinter in the ocean, and do not make extensive oceanic migrations (Johnson et al. 1999). Coastal cutthroat trout exhibit both anadromous and resident life-history forms. Resident fish are often found in the uppermost reaches of drainages, often above barriers to anadromous fish migration. Cutthroat trout, like steelhead, do not always die after spawning. Adults have been reported to spawn each year for more than 6 years (Howard 1999).

The Smith River is considered an important coastal cutthroat trout stream because the species has been reported to occur in nearly all of its tributaries, including Mill Creek (Moyle et al. 1989). Cutthroat trout escapement has not been monitored in Mill Creek (Albro and Gray 2002). Cutthroat trout have proven difficult to observe and count when returning to spawn. In addition, since cutthroat trout do not always die after spawning, carcass counts are impractical as a tool for estimating escapement (Howard 1999).

Cutthroat trout in Mill Creek generally begin spawning in November, with peak spawning occurring in January and February (Howard and Albro 1995, 1997b). Eggs hatch within 6-7 weeks of spawning depending on water temperature. Juveniles may migrate to sea during their first year, but may rear in fresh water for up to 5 years before migrating to coastal waters (Trotter 1987, Pauley et al. 1989). Cutthroat trout smolts in Mill Creek outmigrate over an extended period, generally from early April through June; peaks in outmigration appear irregular, with no consistent pattern noted to date (Albro and Gray 2002). Juvenile cutthroat trout captured in the outmigrant traps may be outmigrating to estuarine or ocean habitats or simply dispersing within the river system. Outmigrant trapping has been conducted in Mill Creek since 1994. All life stages of cutthroat trout (e.g., fry, juveniles, smolts, and adults) have been captured. Because juvenile steelhead and coastal cutthroat trout are difficult to distinguish from one another, numbers of juvenile cutthroat trout captured may include some steelhead. Numbers of cutthroat trout smolts (ages 2+ and 3+) captured in the traps has ranged from a low of 18 in 1995 in West Branch Mill Creek and 25 in 1994 in East Fork Mill Creek, to a high of 601 in 1997 in West Branch Mill Creek and 560 in 1997 in East Fork Mill Creek (Albro and Gray 2002). Adult cutthroat trout spawners or kelts have also been captured. Numbers of captured adults has ranged from a low of 11 in 1994 in West Branch Mill Creek and 13 in 1994 and 1995 in East Fork Mill Creek, to a high of 44 in 1997 in West Branch Mill Creek and 46 in 1997 in East Fork Mill Creek (Albro and Gray 2002).

Chum salmon

Chum salmon were first documented in Mill Creek in 1984 and are highly variable and inconsistent in spawning (J. Waldvogel, pers. comm. 2002). Chum salmon in the Mill Creek watershed belong to the Pacific Coast ESU. This ESU was determined to be not warranted for listing as federally threatened or endangered by NMFS in March 1998. The NMFS status review (Johnson et al. 1997) indicated that chum salmon from this ESU are found over a large and diverse geographic area from the Strait of Juan de Fuca to at least southern Oregon and possibly northern California, and may historically have extended to the recorded extreme southern limit of the species' distribution near Monterey, California. Whether or not streams in northern California support permanent naturally reproducing populations of chum salmon is unknown. Chum salmon spawning in Mill Creek may represent episodic colonization from more northern populations.

Chum salmon usually spawn in the lowermost reaches of streams, constructing redds in mainstem reaches or side channels from just above tidal influence to nearly 100 km (62 mi) from the sea. Chum salmon in Washington and Oregon return to fresh water in October and November and spawn as late as December, although limited data are available (WDF et al. 1993, Kostow 1995). Chum salmon in West Branch Mill Creek have been observed to spawn in December (J. Waldvogel, pers. comm., 2002). Juvenile chum salmon usually outmigrate to marine habitats almost immediately after emerging from redds (Salo 1991). Survival and growth therefore depend less on freshwater habitat conditions than on favorable estuarine conditions.

Chum salmon smolts were first captured in Mill Creek outmigrant traps in 1996, when 3 were captured in East Fork Mill Creek and 100 in West Branch Mill Creek. Since then, only 5 chum salmon were captured in West Branch Mill Creek in 1999 and 4 in 2000. No juvenile chum salmon have been captured in the West Branch and East Fork Mill Creek trap since 1996 until 2002, when numerous juvenile chum salmon were captured (Albro and Gray 2002). Increased numbers of spawning adults and carcasses were observed during 2001-2002 spawner surveys. In addition, increased numbers of smolts were captured in outmigrant traps in 2002 (C. Howard, pers. comm., 2002). The pattern of chum salmon spawning in Mill Creek appears to support the BRT's conclusion that chum salmon spawning in northern California may be intermittent and dependent on colonization from populations further north.

2.9.3 Fish habitat enhancement activities

LWD and structural habitat complexity may have been reduced due to past management activities on the Mill Creek property (Stimson Lumber Company 1998). In an effort to enhance fish habitat, Stimson began placing large logs and boulders in stream channels on the property in 1995. The approximate locations and numbers of completed in-stream enhancement projects include Bummer Lake and Bummer Creek (15), the southeast tributary to East Fork Mill Creek (15), east branch of the East Fork Mill Creek (15-20), an unnamed tributary "Kelley Creek" south of East Fork Mill Creek (10-15), and West Branch Mill Creek (15). Coho salmon and other juvenile salmonids appear to be using these in-channel structures (S. Bauer, pers. comm., 2002).

Silvicultural treatment of riparian stands to accelerate regrowth of conifers and LWD recruitment to stream channels has also been conducted on the property (Section 2.2.1 Commercial timber harvest and Section 2.6 Stream Channel Characteristics). In addition, some stream crossings on the property were modified to improve upstream fish passage in the early 1990s (S. Bauer, pers. comm., 2002).

2.10 Wildlife

Based on the number of plant communities and variety of habitat types found on the property, it is likely that wildlife diversity is relatively high. Although reptile diversity is low, shaded seeps and streams and old-growth forest habitats on the property likely provide habitat for a variety of amphibians, including southern torrent salamanders (*Rhyacotriton variegatus*), tailed frogs (*Ascaphus truei*), Del Norte salamanders (*Plethodon elongatus*), and foothill yellow-legged frogs (*Rana boylii*).

Small mammals adapted to forest habitats in this area include deer mice (*Peromyscus maniculatus*), dusky-footed woodrats (*Neotoma fuscipes)*, northern flying squirrels (*Glaucomys sabrinus*), California red tree voles (*Arborimus longicaudus*), and red-backed voles (*Clethrionomys californicus*). Several bat species, including long-eared myotis (*Myotis evotis*) and long-legged myotis (*Myotis volans*), may also occur on the property. Larger mammals known to occur in Del Norte County include gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), black bear (*Ursus americanus*), river otter (*Lutra canadensis*), mink (*Mustela vison*), Pacific fisher (*Martes pennanti pacifica*), bobcat (*Felis rufus*), mountain lion (*Felis concolor*), black-tailed deer (*Odocoileus hemionus)*, and Roosevelt elk (*Cervus elaphus rooseveltis*). Humboldt marten (*Martes americana humboldtensis*) are believed to be extremely rare or extinct. Marten tracks were recently found in lands southeast of the Mill Creek property; however, the identification of these tracks has been unconfirmed (J. Harris, pers. comm., 2002).

Bird species on the property include neotropical migrants, such as purple martin (*Progne subis*), yellow warbler (*Dendroica petechia*), and Vaux's swift (*Chaetura vauxi*), and old-growth-associated species such as northern spotted owls (*Strix occidentalis caurina*) and marbled murrelets (*Brachyramphus marmoratus*).

2.10.1 Special-status wildlife species

Several threatened, endangered, and special concern animal species are known to occur in the Mill Creek area. Other species have not been documented to occur, but the property may provide suitable habitat. All special-status wildlife species that potentially occur on the Mill Creek property are listed in Table 2-9. Three of these species are listed as federally threatened: bald eagle, marbled murrelet, and northern spotted owl. Bald eagles and marbled murrelets are also listed as endangered under the California Endangered Species Act. Five amphibian species, twelve bird species, and three mammal species of special concern also have to be considered during preparation of environmental documents related to CEQA. Species summaries for these and two additional species of interest - black bear and Roosevelt elk - are included in Appendix C.

Table 2-8. Special-status species and additional species of interest occurring or potentially occurring on the Mill Creek property.

COMMON NAME	SCIENTIFIC NAME	STATUS [1]		PRESENT[2]
		Federal	State	
Amphibians				
Del Norte salamander	*Plethodon elongatus*		P, CSC	P
Southern torrent salamander	*Rhyacortriton variegatus*		P, CSC	P
Foothill yellow-legged frog	*Rana boylii*		P, CSC	P
Northern red-legged frog	*Rana aurora aurora*		P, CSC	P
Tailed frog	*Ascaphus truei*		P, CSC	P
Insects				
Mardon skipper	*Polites mardon*	C		nearby
Birds				
Double-crested cormorant	*Phalacrocorax auritus*		CSC	
Great egret	*Ardea alba*		O	
Northern goshawk	*Accipiter gentilis*		CSC	
Sharp-shinned hawk	*Accipiter striatus*		CSC	
Cooper's hawk	*Acipiter cooperii*		CSC	
Golden eagle	*Aquila chrysaetos*		CSC	
Bald eagle	*Haliaeetus leucocephalus*	T	E, P	R (W)
Ruffed grouse	*Bonasa umbellus*		CSC	
Marbled murrelet	*Brachyramphus marmoratus marmoratus*	T	E, P	P
Northern spotted owl	*Strix occidentalis caurina*	T	O	P
Peregrine falcon	*Falco peregrinus*		P	
Purple martin	*Progne subis*		CSC	
Vaux's swift	*Chaetura vauxi*		CSC	
Yellow warbler	*Dendroica petechia*		CSC	
Yellow-breasted chat	*Icteria virens*		CSC	
Mammals				
Black bear	*Ursus americanus*			P
California red tree vole	*Arborimus pomo*		CSC	P
Humboldt marten	*Martes americana humboldtensis*		CSC	nearby, report has not been confirmed
Pacific fisher	*Martes pennanti pacifica*		CSC	R
Roosevelt elk	*Cervus elaphus rooseveltis*			P

[1] T = Threatened
E = Endangered
P = Protected by the State of California
CSC = Species of Concern
O = Species classified as Species of Concern by California Dept. of Fish and Game and/or California Board of Forestry

[2] P = Present based on Stimson Lumber Company (1998), CDFG (2000)
R = Rare
W = overwintering only

2.10.2 Threatened and endangered wildlife species

Marbled murrelet

Life history and habitat requirements
Marbled murrelets are distributed from Alaska to central California. They forage on fish in coastal ocean waters within 1.6 km (1 mi) of shore, and roost and nest on shore in old-growth coniferous forests. The breeding season lasts from late March through early September, with nesting beginning between early April and early July. For nesting, marbled murrelets require old-growth coniferous forest located close to marine habitats (typically within 81 km [50 mi]) with abundant near-shore food resources (Nelson and Singer 1994). Preferred nesting habitat generally consists of multi-storied stand with a large component of old-growth trees and moderate to high canopy closure (Miller et al. 1995). Miller and Ralph (1996) found that dense crown cover of old-growth trees was a dominant factor influencing stand occupancy in northwestern California. Average canopy cover over identified nests has been reported to be approximately 85% (USFWS 1995c). In California, stand dominance by redwood, in conjunction with dense canopy cover, is important for predicting marbled murrelet occupancy (Nelson 1997). A typical old-growth forest used for nesting by marbled murrelets is characterized by large trees >80 cm (32 in) dbh (Miller et al. 1995). In some areas in California, marbled murrelet activity has been documented in residual old-growth stands, but all of these stands were adjacent to large old-growth stands and no nests were found in these stands (CDFG 1992, as cited in USFWS 1995c). Mature second-growth forest stands do not appear to be used by murrelets if they are isolated from old-growth forest stands (Larsen 1991, as cited in Miller et al. 1995); however, recent observations in Mendocino County have indicated that isolated residual stands may be providing nesting habitat (J. Hunter, pers. comm., 2002).

Marbled murrelets do not build a traditional nest, but lay a single egg on a large flattened branch or natural platform hidden in the upper canopy of a tree. The egg is usually prevented from rolling off the branch by a small depression or cup made in moss or other natural debris on the limb (Miller et al. 1995). In Douglas-fir and redwoods, eggs are frequently placed on duff platforms (Hamer and Everett 1996). According to Hamer and Nelson (1995), nesting habitat features are chosen in part to reduce predation. Nest sites are not located directly on the coast, thereby avoiding the heaviest concentrations of predators such as gulls and corvids (ravens, crows, and jays). Elements likely selected to decrease detectability of nests to avian predators include dense old-growth with a multi-layered canopy, and sections of branches with high overhead and horizontal cover near tree trunks, where the trunk itself contributes to nest concealment. Behavioral adaptations to reduce predation include shifting incubation duties only once every 24 hours and feeding chicks infrequently, thus minimizing the frequency of flights from the ocean to the nest (Nelson and Hamer 1995).

Sensitivity to anthropogenic disturbance
Because this species relies on old-growth coniferous forest located close to ocean waters for nesting habitat, timber harvesting presents a significant threat. Fragmented forests often have extensive tracts with reduced canopy closure, which allows predators to more easily access both eggs and adults. Forest fragmentation also leads to a general increase in reproductive habitat for predators such as ravens and crows, resulting in greater predator densities (Miller et al. 1995). Many nests found to date have been located at stand edges. Such nests have been subjected to high levels of predation and impacts of human disturbance. Stands farthest from human activity tended to experience the least predation (Marzluff et al. 1997). Successful nests tend to be located significantly farther from forest edges than nests of less productive pairs (mean = 155.4 m versus 27.4 m, USFWS 1995c).

Populations of corvids and other predators are expanding due to the spread of suburbs, forest fragmentation, and opening of the forest canopy, which ultimately increases corvid nesting and foraging

habitat (Ehrlich et al. 1988, Shuford 1993). Compared with other alcids that typically do not nest in forest habitats, marbled murrelets are believed to be more vulnerable to nest predation (USFWS 1997). The increased role of predation in the decline of this species is probably strongly linked with anthropogenic influences; particularly forest fragmentation and ensuing edge effects. Human recreational activities may also result in increased densities of avian predators, including crows, ravens, and Steller's jays.

Marbled murrelet nesting on the Mill Creek property

The entire Mill Creek area is within the breeding range of the marbled murrelet (USFWS 1995c, Stimson Lumber Company 1998), and is located within the marbled murrelet Recovery Zone 4 - Siskiyou Coast Range, which extends from North Bend, Oregon to southern Humboldt County, California (USFWS 1997). Stimson Lumber Company (1998) identified several stands occupied by murrelets. These stands included Hamilton Buffer, Paragon, and George's Saddle (Table 2-9). Occupancy of the George's Saddle stand by murrelets did not appear to be continuous and its current status is unknown. Two additional stands (Planing Shed and Cedar Creek) were identified by CDFG as suitable nesting habitat and are linked to occupied habitat on adjacent park land.

The Hamilton Buffer stand covers approximately 6 ha (14 ac) and is located over 0.8 km (0.5 mi) south of the nearest suitable habitat on state or federal park lands. The stand is surrounded by stands from 3 to 60 years old with approximately 75% of the stand edge bordered by stands 31 years old or younger. The entire stand is subject to varying degrees of environmental and predation influences due to its proximity to exposed forest edge within 91 m (300 ft). Several buildings and a mainline road are within than less a quarter-mile of Hamilton Buffer.

The Paragon stand covers approximately 38 ha (95 ac) and is located >3 km (>2 mi) from the nearest suitable habitat on state or federal park lands. Surrounding stands range in age from 8 to 31 years old. About 7 ha (17 ac) are considered to have interior forest conditions, as they are located >91 m (>300 ft) from the forest edge, whereas 30 ha (73 ac) are within 91 m (300 ft) of exposed forest edge and are subject to environmental and predation influences associated with the edge. Paragon was surveyed by Mad River Biologists (McKinleyville, California) in 2001. No marbled murrelet detections were made; however, this does not necessarily mean that murrelets are not using the stand.

George's Saddle covers 12 ha (29 ac), is heavily influenced by edge effects, and is isolated from larger areas of suitable habitat. Cedar Creek and Planing Shed are 24 ha and 1 ha (60 ac and 3 ac), respectively. They are located in close proximity to occupied habitat on national and state park lands. Cedar Creek contains potentially suitable marbled murrelet nesting habitat.

Table 2-9. Stands with marbled murrelet detections and observed occupied behavior between 1991 and 1997.

STAND	STAND SIZE		SURVEY RESULTS		YEARS SURVEYED	STATUS
	ha	ac	no. of detections	no. of occupied behaviors		
Cedar Creek	24	60	23	0	1992-1993	contiguous with occupied habitat
George's Saddle	12	29	0	0	1996-1997	presumed unoccupied, but detections were recorded in 1994
Hamilton Buffer*	6	15	86	69	1992 and 1994	presumed occupied
Paragon	36	90	244	196	1992-1994	presumed occupied
Planing Shed	1	3	0	0	0	contiguous with occupied habitat

* 2001 survey did not result in any detections (A. Brickey, pers. comm. 2002)

Little is known regarding the relationship between murrelet behavior and nesting status, or about year-to-year variation in detection rates. A lack of detections while conducting standardized surveys does not necessarily imply that murrelets are not present, because marbled murrelets can be extremely difficult to detect (CDFG 1997). Marbled murrelets fly rapidly through the forest and are usually only briefly present over survey stations. Survey results can be influenced by levels of extraneous noise, visibility from survey stations, and skill of observers (O'Donnell 1995). Researchers in Oregon have documented the presence of murrelet nests after climbing trees in stands that did not yield detections via the survey protocol (CDFG 1996).

Northern spotted owl

Life history and habitat requirements

Northern spotted owls are distributed from southwestern British Columbia south through western Washington and Oregon to Marin County, California (USFWS 1994). In 1992, the USFWS designated critical habitat for northern spotted owls, including over 1,409,000 acres within California (USFWS 1992). Spotted owls are associated with mature and old-growth forest stands. Second-growth forests older than 40 years and forest stands as small as 0.4 ha (1 ac) (or less if they contain remnant old-growth trees) are considered suitable northern spotted owl habitat. Suitable habitat is characterized by a high degree of structural complexity, including high canopy closure (>70%), multi-layered canopy, large diameter trees, large snags, and large accumulations of downed wood (Gutièrrez et al. 1998). The overstory should contain trees that are at least 53 cm (21 in) dbh and that comprise at least 40% of the total canopy closure. Inland forests with less than 40% canopy cover may be considered as suitable habitat.


Northern spotted owl.

Northern spotted owls have relatively large home ranges (Forsman et al. 1984). Reported home range sizes in California range between 503 and 3,129 ha (1,258 and 7,823 ac) (Thomas et al. 1990). There is generally a large degree of overlap between the home ranges of members of the same pair (Forsman et al. 1984, Solis and Gutièrrez 1990) and less overlap among adjacent pairs. Home range sizes vary geographically (Carey et al. 1992), and generally increase with decreasing amount of old-growth forest (Forsman et al. 1984, Thrailkill and Meslow 1990). Home range size has also been correlated with diet preference; home ranges tend to be larger when flying squirrels are the primary prey item and smaller when woodrats are the primary prey (Zabel et al. 1995, as cited in Gutièrrez et al. 1995).

Forsman et al. (1984) found that nests were built in cavities of old-growth conifers or on platforms of sticks or other debris in mature or old-growth conifers. Most of the cavity nests were in cavities formed when tops of old-growth trees had broken off, exposing the hollow center of the tree. Over half of the nests used on platforms were built by other species (northern goshawks, Cooper's hawks, red-tailed hawks, woodrats, and squirrels). In more mature and structurally complex forests, spotted owls tend to use broken-top trees and cavities more frequently than platforms (LaHaye 1988, Buchanan 1991, Gutièrrez et al. 1995). In northern California, nesting habitat commonly consists of Douglas-fir trees with an average age of 300 years, an average height of (28 m) 92 ft, and tree diameters ranging from 119 to 157 cm (47 to 62 in) dbh.

Foraging habitats vary more than roosting and nesting habitats (Thomas et al. 1990), but are also characterized by high canopy closure and complex structure (USFWS 1994). Some open areas can be beneficial, as the availability of some prey may increase in disturbed areas (Folliard et al. 2000). Spotted owls are probably not able to maneuver as well in young stands that may support the highest prey

abundance (Zabel et al. 1993, as cited in Thome et al. 1999); therefore, they are likely to forage in stands that are young enough to contain an abundance of small mammal prey, such as woodrats, but old enough to allow the owls to fly beneath the canopy (Thome et al. 1999). The majority of the diet is composed of mammals, especially dusky-footed woodrat. Predators include great horned owls, whose numbers may increase with forest fragmentation and opening of the canopy.

Sensitivity to anthropogenic disturbance

Timber harvesting can directly affect spotted owl nesting, roosting, and foraging habitat by removing large trees and opening the canopy. Northern spotted owls have a low tolerance for high temperatures, which may increase with forest fragmentation. Forest fragmentation may also isolate populations and provide open areas for great horned owls, a predator of the spotted owl. Furthermore, physiological stress may be increased by indirect effects of timber harvesting, roads, and recreational activities.

Northern spotted owl use of the Mill Creek property

Based on analyses conducted by Stimson Lumber Company for their HCP (1998), the Mill Creek property was estimated to contain approximately 1,074 ha (2,654 ac) of northern spotted owl nesting habitat, 2,662 ha (6,578 ac) of resident foraging habitat, and 282 ha (696 ac) of non-resident foraging habitat in 1998.

The Mill Creek property was systematically surveyed for northern spotted owls between 1989 and 1999 by Stimson Lumber Company. In addition, adjacent land has been surveyed by Stimson Lumber Company, Arcata Redwood Company, and the National Park Service. There are currently several recorded spotted owl sites in the Mill Creek area (Table 2-10). An additional three sites have been recorded within 2 km (1.3 mi) of the property, representing one or two additional pairs of owls (Stimson Lumber Company 1998).

The species was also reported in the following USGS quads covering the property and adjacent areas (CDFG 2000). Adjacent areas were included due to the possible migration and dispersal of animals into the Mill Creek property.

Crescent City	*NA*
Hiouchi	1982, 1984, 1988, 1989, 1990
Sisters Rock	*NA*
Childs Hill	1990
Cant Hook Mountain	1984, 1989, 1990

Table 2-10. Summary of owl activity at resident owl sites on and within 2 km (1.3 mi) of the Mill Creek area as of 1999 (Stimson Lumber Company 1998).

SITE NAME	STATUS IN 1999[1]	COMMENTS
George's Saddle	S	George's Saddle contained a pair during 1990-1999, which nested in 1992, 1993, 1995, and 1997. The female could not be located in 1999.
George's Saddle	P	This pair started in 1996.
Biltmore	U	Alternative nest site for George's saddle (abandoned 1999).
Industrial Pond	S	Occupied between 1996 and 1999.
Paragon	U	Pair was present 1994-95, nested 1996-1997, but could not be located in 1999.
Paragon	P	Started in 1997.
Kelly Creek	S	Non-breeding pair in 1997, single since 1998. A male fledged in 1994, female left.
Mill Creek Campground	P	Pair since 1998.
Airport	U	Pair, two owls (pair status unknown), and single owl observed during 1992 1996. The site unoccupied in 1997 99.
West Fork Hunter Creek	P	Active pair since 1992.

[1] P = Pair, S = single owl, U = unoccupied

Bald eagle

Due to nationwide increases in the abundance of bald eagles, the USFWS (1995a) reclassified the status of bald eagles in the lower 48 states from endangered to threatened in 1995. In 1999, the USFWS (1999) proposed to remove the species from the list of endangered and threatened species. A decision on this proposal is still pending.

Life history and habitat requirements

Bald eagles are distributed across North America. On the Pacific coast, they breed from Alaska to Baja California. The Klamath Basin is an important overwintering area for bald eagles in California. Bald eagles require large bodies of water or free-flowing rivers for foraging. In winter and during migration they can be found where there are evening roost sites and open water bodies with sufficient food.

Nest trees are usually located close to a permanent body of water in mountainous regions, as fish are the primary food of nesting bald eagles (Marshall et al. 1996). Very large trees in stands with approximately 40% canopy cover are preferred for nesting. The nest tree is often the dominant or codominant tree in the surrounding stand (Lehman 1979), and must be sturdy and able to support a very large and heavy stick nest. Adults often utilize the same breeding areas year after year. Nests are often re-used and/or re-constructed each year (USFWS 1999). Breeding areas may include one or more additional nests among which the eagles alternate from year to year (Thelander et al. 1994). One to three eggs are laid and both parents participate in the incubation. Bald eagles are easily disturbed during nesting and require areas free of human disturbance for successful reproduction.

Bald eagles typically form large communal roosts at traditional sites during the winter (Thelander et al. 1994). They commonly roost in mature or old-growth forest stands, but roost sites have also been found in large deciduous trees (Marshall et al. 1996). During winter, eagles seek areas offering abundant and available food supplies. Important perch and roost sites include snags and dead-topped live trees located in areas with minimal human disturbance (Brown and Stevens 1997, USFWS 1995a).

In the Klamath National Forest, winter roost sites were approximately 16-19 km (10-12 mi) from foraging areas (Zeiner et al. 1990a). Roosting sites are generally located close to open water where good perch trees and night roosts are available nearby (USFWS 1995a). The location and use of roost sites varies, but may be 32.2 km (20 mi) or more from feeding sites (Marshall et al. 1996). Wintering sites must have suitable night roosts that offer isolation and thermal cover from winds (USFWS 1999). During the day, bald eagles typically perch on horizontal branches of deciduous trees along lakes and rivers (Marshall et al. 1996).

Bald eagle use of the Mill Creek property

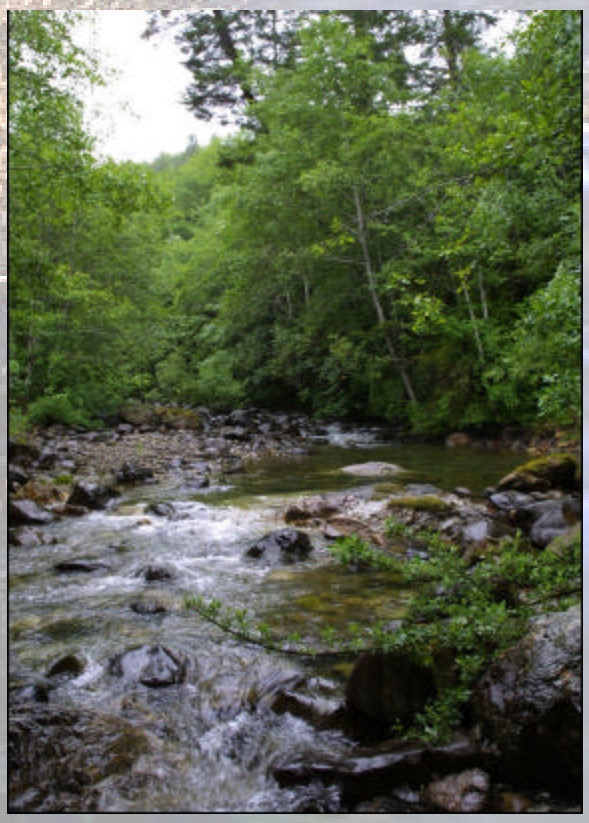
Bald eagles have not been observed nesting on the Mill Creek property, but have been observed there during the winter (Stimson Lumber Company 1998). The nearest nest that has been observed is located in the Smith River basin. Both Mill Creek and Rock Creek may provide foraging habitat for wintering eagles that feed on anadromous salmonid carcasses, and eagles have been observed feeding on anadromous salmonid carcasses on the Mill Creek property during the winter. Stimson Lumber Company (1998) estimated that the property contained about 3,671 ha (8, 671 ac) of potential bald eagle nesting/roosting habitat and about 40 km (25 mi) of streams suitable for bald eagle foraging.

2.11 Cultural Resources

The Crescent City area was home to the Tolowa Indians who lived in approximately eight villages along the coast, with seven of them containing as many as 300 persons each (Gould 1978). The Tolowa were in regular contact with neighboring tribes such as the Yurok, Karok, Hupa, and Tututni. They participated in ceremonial interactions with these tribes as well as trading, which extended north to the interior of Oregon and along the Pacific coast as far as Puget Sound, Washington. Unlike the tribes to the north and south, the Tolowa settled primarily along the coast and did not frequently use inland areas due to the rugged and heavily forested terrain of the Smith River area (L. Mayo, pers. comm., 2002). The Tolowa used the Mill Creek area for resource collection, including but not limited to basketry supplies, timber for canoe and shelter construction, and food.

Chapter 3

Analysis of Interim Management Opportunities



3 ANALYSIS OF INTERIM MANAGEMENT OPPORTUNITIES

The following section describes analyses used to develop recommendations for interim management of the Mill Creek property. The analyses focused on identifying resource protection and enhancement opportunities consistent with (1) the goals and objectives of the acquisition; (2) input from the working groups, public, and advisory council; and (3) the longer-term planning objectives of DPR. Opportunities were prioritized and recommendations were developed based on spatial analysis of potential hazards, risks, and benefits to resources during the interim period. The analysis was based on existing information from Stimson Lumber Company and other private and public sources.

3.1 Road Management

Road use and maintenance affects all aspects of property management including public use, habitat protection and enhancement, fuels and fire hazard reduction, second-growth vegetation management, and research and monitoring. The Mill Creek property has a high density of predominantly insloped roads traversing steep terrain that experiences seasonally high rainfall (Table 2-1). These combined factors necessitate intensive maintenance of road drainage features to avoid storm damage and associated delivery of sediment to the stream channel network.

Much of the existing road network constructed for industrial timber management will be an unnecessary liability under future State Park management. A transportation and road management plan will eventually be developed by DPR to identify a permanent road network that will ensure long-term resource protection while meeting access needs for recreation, resource enhancement, administrative programs, research, and monitoring. This plan will require a complete inventory and assessment of existing road conditions, including geomorphic conditions throughout roaded watersheds. The long-term plan will also consider a broad range of administrative, recreational, and socioeconomic issues related to road management.

Prior to developing a long-term road management plan, high priority should be given to removing or reducing the risk of catastrophic erosion by landing or road-stream crossing failure at sites that have the greatest potential to affect aquatic resources during the interim period. We identified priorities for interim road management by conducting risk assessments at landscape and site-specific scales. At the landscape scale, we assigned an erosion risk to areas based on the cumulative score from several hazard indicators. At the site-specific scale, we prioritized risk of road-stream crossing and log landing failure based on existing inventory data. Estimates of risk at these two scales served as the basis for developing (1) strategies that minimize potential road-related erosion during the interim period, (2) recommendations for road monitoring, and (3) priorities for long-term road management and decommissioning.

3.1.1 Landscape-scale erosion risk

The objectives of the landscape-scale erosion risk assessment were to (1) identify terrain where existing roads may present various risk to watershed values, and (2) to prioritize higher risk areas of the road network for detailed assessment and treatment during the interim period. Risk in this context

is defined as the probability of a road accelerating water and sediment yield to stream channels. The risk assessment was based on indicators that imply certain processes or environmental conditions. These associations are based on documented correlations between the indicators (e.g., proximity of roads to stream channels) and the response variables of interest (e.g., hydrologic connectivity) (USDA Forest Service 1999). The actual variables that produce the response may be complex, unmeasured, or unknown. Indicators were derived from digital terrain, stream network, and road network data. The spatial distribution and relationship of indicators across the property was analyzed over a 10-meter grid spacing using a geographic information system (GIS). Each grid cell was assigned a hazard score based on the indicator value. The final risk value assigned was the sum of multiple indicator hazard scores for each grid cell.

Database components

Digital terrain model. A 10-meter digital terrain model (DTM) was generated by merging DTMs created by the California Department of Forestry and Fire Protection (CDF) and the U. S. Geological Survey (USGS). The 10-meter DTM provided the basis for terrain modeling, including slope form and potential instability, channel location and gradient, watershed boundaries and drainage area, and basin position.

Stream network. The California Watershed Assessment Program (CWAP) developed 1:24,000 hydrography (blueline streams) based on USGS Digital Line Graphs and USFS Cartographic Feature Files. The 1:24,000 hydrography often omits small streams predicted by a DTM-derived stream network. We developed an extended blueline network by adding stream reaches mapped by DTM to the blueline stream network. The DTM stream network was computed using a minimum catchment area of 0.04 km^2 (0.02 mi^2) for channel initiation (Montgomery and Foufoula-Georgiou 1993). The blueline and DTM streams were merged to create an extended stream channel network.

Road network. Stimson Lumber Company and RNSP independently developed separate electronic road coverages for the Mill Creek property. Stimson Lumber Company mapped roads within their ownership based on USGS 7.5-minute quadrangles or geographic positioning system (GPS) surveys. RNSP mapped roads, trails, and highways from 1993 and 1998 digital orthophotoquads (DOQ). RNSP road mapping is spatially more accurate, but neither data set represented a complete survey of active and abandoned roads. All of the analyses in the IMR were based on the RNSP road network.

Indicators used in the analysis

Potential slope instability. The relative potential for shallow landsliding was delineated using the model SHALSTAB. SHALSTAB theory is based on the observation that shallow landslides tend to occur in topographic hollows where shallow subsurface flow convergence leads to increased soil saturation, increased pore pressures, and reduced shear strength (Montgomery and Dietrich 1994). The calculated ratio of the effective precipitation, q, to the soil transmissivity, T, is used to map the relative potential for instability. The model assumes that areas with the lowest q/T values represent the least stable ground with the greatest potential for shallow landsliding. Validation studies in the northern California Coast Ranges suggest a critical instability threshold at log q/T values of -2.8 to -2.5 (Dietrich et al. 2001). We defined four stability classes based on log q/T values and assumed that the probability of road-related mass wasting increased with log q/T (Table 3-1). The model is not designed to predict the potential for deep-seated instability such as earth flows and rotational slumps, and generally requires high-resolution DTM data (i.e., 10-meter or finer resolution) for reasonable accuracy.

Table 3-1. Predicted shallow landslide hazard scores using SHALSTAB.

Class	log q/T	Score	Relative Ranking
low potential instability	> -2.8	0	low
moderate potential instability	-2.8 to -3.1	1	moderate
high potential instability	-3.1 to -10	2	high
chronic instability	< -10	3	very high

Slope Position. Slope position refers to the division of a hillslope into zones extending from ridge top to valley bottom that reflect general differences in dominant geomorphic processes. Road hazards typically increase downslope: ridgetop positions are often the driest and most stable for roads, mid-slope positions are often locations where roads intercept subsurface flow, and the lowermost slope positions occupied by the stream and inner gorge are typically wet and subject to mass wasting. We divided hillslopes into four positions, including upper slopes, middle slopes, lower slopes, and low-gradient valley bottoms (Table 3-2).

Table 3-2. Slope position scores.

Class	Score	Relative Ranking
upper 10%	0	low
middle 45%	1	moderate
lower 45%, slopes >10%	2	high
lower 45%, slopes <10%	0	low

Local road density. Road density (miles of road per square mile) is a simple indicator of the concentration of roads in an area. The indicator assumes that subsurface flow interception, concentrated surface runoff, and extension of the road drainage network increase with increasing road density. Road density does not reflect the condition of individual roads and a single road may create large problems in an area with low road density. We calculated road density in a 1-mi^2 moving (USDA Forest Service 1999). Road densities on the Mill Creek property are high compared to adjacent parklands. Average road density over the entire project area is 4.0 km/km^2 (6.4 mi/mi^2). The road density hazard classes therefore reflect a relative risk rather than a commonly used scale of acceptable road density (Figure 3-1, Table 3-3).

Table 3-3. Road density (mi/mi^2) hazard scores.

Class	Score	Relative Ranking
0-6	0	low
6-8	1	moderate
8-12	2	high
lower basin position with slopes <5%	0	low

Stream channel proximity. Roads in close proximity to stream channels are typically more hydrologically connected to the stream channel network. A hydrologically connected road is defined as "any road segment that has a continuous surface flow path to a stream channel."(USDA Forest Service 1999). We addressed potential hydrologic connectivity by identifying road segments located within 100 m of the stream network. Roads located within this 100 m zone received a score of 1 denoting greater potential hydrologic connectivity. Roads located beyond this 100 m zone received a score of 0.

Results

Indicator scores were summed to obtain a composite landscape-scale erosion risk for each 10-meter grid cell (Figure 3-2 and 3-3, Table D-1). Cumulative scores were then assigned to individual road segments passing through each unique grid cell, and an additional score for proximity to stream channels was assigned to road lengths to obtain a composite erosion risk by road length (Figure 3-2 and 3-4, Table D-1). Tables 3-4 and 3-5 indicate the composite classes for erosion risk by area and road length.

Table 3-4. Composite scores for landscape-scale erosion risk by area.

Cumulative Score	Relative Ranking
0	low
1-2	moderate
3-4	high
5-7	very high

Table 3-5. Composite scores for landscape-scale erosion risk by road length.

Cumulative Score	Relative Ranking
0	low
1-2	moderate
3-4	high
5-8	very high

The highest road densities (> 8 mi/mi^2) occur in (1) the northern portion of the upper East Fork Mill Creek along the shared divide with Bummer Lake Creek, (2) the northern portion of the upper West Branch Mill Creek, (3) the east-facing slopes descending to the central portion of Rock Creek, and (4) the headwater portions of Rock Creek near the shared divide with Terwar Creek (Figure 3-1). High erosion risk areas are located at the mid and lower slope positions in each of the major subbasins, most notably Bummer Lake Creek, the upper reaches of the East Fork and West Branch Mill Creek, and throughout Rock Creek (Figure 3-2, Table D-1). These areas occupy 34 km^2 (13 mi^2), or approximately 33% of the property area. Approximately 166 km (103 mi) of road, or 41% of the total property road length occur in high erosion risk areas. Very high erosion risk is primarily associated with inner gorge slopes and well-defined topographic hollows. These areas occupy 3.4 km^2 (1.3 mi^2), or approximately 3.3% of the property area. Approximately 36 km (22 mi) of road, or 9% of the total property road length occur in very high erosion risk areas. Areas of predicted high and very high erosion risk are generally coincident with unstable areas mapped from aerial photography during development of Stimson Lumber Company's Draft HCP (Stimson Lumber Company 1998). Roads located in areas of high and very high erosion risk may be more prone to altered drainage, subsurface flow interception, stream diversion, and stream crossing failure. The drainage network in these areas is dominantly comprised of source and transport channel types that effectively deliver sediment to downstream reaches. This analysis of erosion risk may underestimate potential instability associated with high pore water pressures that develop at the basal contact of Pliocene alluvial deposits capping ridge crests in the vicinity of Childs Hill.

Figure 3-1. Road density and road stream crossings.

Figure 3-2. Map of landscape-scale erosion risk.

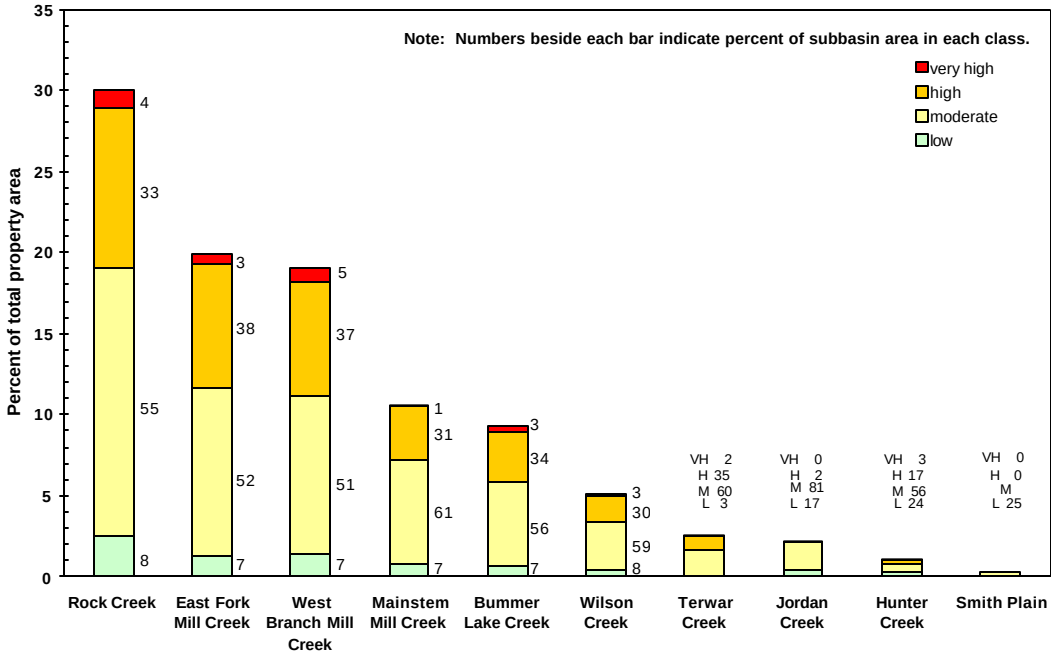


Figure 3-3. Landscape -scale erosion risk by area.

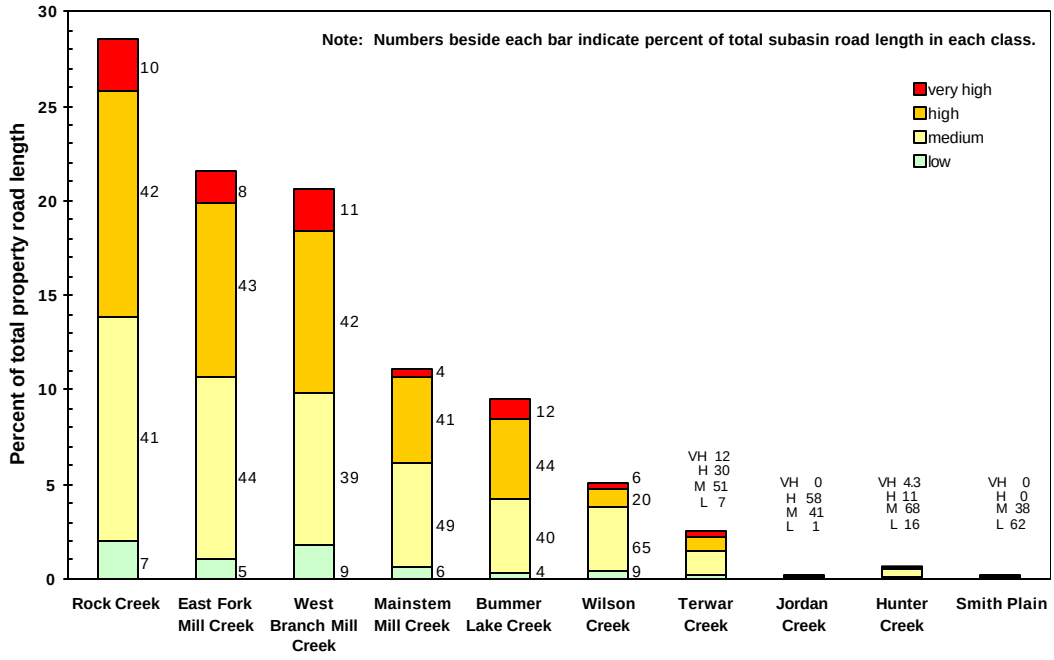


Figure 3-4 Landscape -scale erosion risk by road length.

3.1.2 Site-specific road risk assessment

The objectives of the site-specific road risk assessment were to identify road-stream crossings and log landings with the greatest potential to affect watershed values by failure or diversion, and to prioritize higher risk sites for detailed assessment and treatment during the interim period. The risk assessment was based on (1) road inventories conducted on the Mill Creek property between 1995 and 1997 (PWA 1996, 1997, 1998), (2) current road and stream crossing conditions described by Stimson Lumber Company, and (3) recent field observations of existing conditions along the primary (haul) roads by Stillwater Sciences.

Database components

The Pacific Coast Fish, Wildlife, and Wetlands Restoration Association (PCFWWRA) and Pacific Watershed Associates (PWA) conducted a systematic inventory of log landings, roads, and adjacent hillslope conditions on the Mill Creek property in 1995-1997. The purpose of the inventory was to (1) identify existing and potential sediment sources along active and abandoned roads, and (2) to develop prescriptions for cost-effective erosion prevention work that would minimize future sediment yield to the stream network (PWA 1996). The inventory database contains attributes describing log landing and road-stream crossing conditions; potential for culvert plugging, stream diversion, and erosion; estimates of potential erosion volume; and treatment immediacy.

Stimson Lumber Company has continually maintained and upgraded their roads and stream crossing infrastructure since the inventories were conducted, although there are no maintenance records documenting these changes (K. Stowe, pers. comm., 2002). Between 1999 and 2002, Stimson partially decommissioned approximately 60 miles of road in order to reduce diversion potential and potential erosion volume at high risk stream crossings. Several large winter storms during the past 5 years have also dramatically changed road and stream crossing conditions since the 1995-1997 road inventories were conducted.

In the absence of recent maintenance records and a systematic inventory of current road and log landing conditions, the risk assessment in this interim management plan is based on field estimates of erosion potential, potential erosion volume, and diversion potential identified in the 1995-1997 PWA database (Tables 3-6, 3-7, and 3-8). We acknowledge that site changes since the inventory was conducted create uncertainty in the prioritization of risk and future treatment. The inventory data, however, are currently the best available information and we assumed a similar distribution of existing risk.

Table 3-6. Erosion potential scores.

Erosion Potential	Score	Relative Ranking
low	0	low
moderate	1	moderate
moderately high	2	high
high	3	very high

Table 3-7. Potential erosion volume (yd^3) scores.

Volume Class (yd^3)	Score	Relative Ranking
0	0	low
1-100	1	moderate
100-700	2	high
>700	3	very high

Table 3-8. Diversion potential scores.

Diversion Potential	Score	Relative Ranking
no	0	low
yes	3	high

Results

Scores were summed for erosion potential, potential erosion volume, and diversion potential attributes to obtain a cumulative risk for each road-stream crossing (Figure 3-5, Table 3-9 and D-2) and log landing (Figure 3-6, Table 3-10).

Table 3-9. Composite scores for site-specific road-stream crossing risk.

Cumulative Score	Relative Ranking
0	low
1-3	moderate
4-6	high
7-9	Very high

The majority of the very high risk crossings occur along the main (haul) roads, including the Rock Creek-Childs Hill loop, Bummer Lake Road, and West Ranch Road (Figure 3-5). The greatest concentration of crossings occurs in the Rock Creek basin, followed by Bummer Lake Creek, upper West Branch Mill Creek, and East Fork Mill Creek. Areas with high concentrations of high risk crossings generally coincide with areas of very high road density (>8 mi/mi^2) (Figure 3-1) and high landscape-scale erosion risk (Figure 3-2). Large, high-risk log landings are predominantly located in the Rock Creek basin (Figure 3-6, Table 3-10). The most notable high risk secondary roads on the property include Teran Road, Smokehouse Road, Sec 1 Road, Fourth Switchback, Boulder Avenue, Howard Spur, Crossover Spur, Cabin Spur, Wilbur Spur, and Airport Spur. This analysis indicates Rock Creek is the subwatershed planning area with the greatest erosion risks due to a combination of very high road density, abundant high-risk road-stream crossings and large log landings, and a relatively large proportion of potentially unstable slopes that have been recently harvested.

Figure 3-5. Map of road-stream crossing risk.

Figure 3-6. Map of landing erosion risk.

Table 3-10. Summary of log landings by subwatershed area.

Subwatershed	Number of Landings	Potential Erosion Volume (yd^3)
Rock Creek	31	52,870
West Branch Mill Creek	13	3,600
Bummer Lake Creek	3	1,860
East Fork Mill Creek	5	1,660
Upper Hunter Creek	1	630
Wilson Creek	1	440
Main Stem Mill Creek	1	390
Upper Terwar Creek	1	170
Total	**56**	**61,620**

3.2 Vegetation Management

More than a century of industrial timber management on the Mill Creek property has resulted in a landscape dominated by even-aged, early-successional conifer plantations that lack structural complexity and biological diversity. The goals and desired future conditions under DPR management are to restore the complexity, diversity, and ecological values of late-successional forests on the property. DPR will eventually develop long-term forest and fire management plans for the Mill Creek property or adopt existing plans applied to adjacent parklands. The benefits of implementing these management plans will be attained slowly over many decades or centuries. Opportunities to attain these objectives and ecological values may be severely constrained if existing young plantation forests are not actively managed during the shorter interim period. Much of the second-growth forest on the property is at a critical stage in physiological development in terms of the ability to release after thinning and retain health and vigor. Delaying thinning may result in reduced crown ratios, greater susceptibility to windthrow, and stand deterioration due to overcrowded conditions.

DPR can implement thinning of young stands as a management tool to accelerate restoration of old-growth forest characteristics, or it can allow these stands to develop old-growth characteristics through natural processes over a much longer timeframe that may require several stand replacing events (e.g., wildfire or windstorms). Large second-growth reserves previously managed for timber production, such as those in Redwood National Park and on the Mill Creek property, may not develop the late-successional characteristics that were originally present under natural disturbance conditions (Thornburgh et al. 2000). Second-growth forests may not resemble naturally regenerated stands that establish after natural disturbance events due to (1) denser and more uniform replanting often with species other than those present in the original stands or with non-local genotypes; (2) altered species composition and seed supply due to past timber harvesting; (3) introduction and establishment of exotic flora and fauna; (4) fire suppression; (6) changes in climate conditions since establishment of old-growth forests; and (7) continued forest fragmentation. Several examples demonstrate that thinning young conifer plantations using variable density, irregular gap techniques can accelerate development of late-successional characteristics, including experimental treatments on federal forest

lands in Oregon and Washington (USDA Forest Service 2002), on RNSP lands (RNSP 1996), and on the Mill Creek property (Oliver et al. 1994).

Interim management objectives include promoting development of old-growth forest characteristics and minimizing the risk of catastrophic wildfire, both of which can be attained through silvicultural methods. We established priorities for vegetation management during the interim period by identifying young second-growth forests where forest restoration would provide the greatest potential ecological benefits and would most effectively reduce catastrophic wildfire risk. We also identified areas affected by plant pathogens and the potential pathways for dispersal of pathogens.

We identified opportunities and established priorities using a matrix approach similar to the risk assessment for road management. Indicators were assigned various scores based on their relative influence on the desired objective. Higher scores reflect a greater risk or management priority. The spatial distribution and coincidence of indicators across the property were analyzed over a 10-meter grid spacing using GIS. The cumulative score for each grid cell was then used to establish priority areas for interim management activities, such as thinning for ecological benefits and fuels reduction.

Database components

Vegetation coverage
Stimson Lumber Company developed an electronic vegetation database to manage industrial forests and associated natural resources within their ownership. The California Vegetation (CALVEG) polygon coverage from which the database originated was substantially modified by Stimson to track stand age and silvicultural treatments. Database attributes used in this analysis include (1) date of stand birth (time since regeneration began) based on aerial photographs dating back to the 1950s, and (2) vegetation type based on aerial photograph interpretation and/or field mapping. Table 2-4 describes the vegetation types in the database. We did not know the extent to which existing vegetation attributes have been updated since initial field mapping or photo interpretation. We assumed the coverage was current through 1999, and we updated stand age and type to incorporate timber harvest through the last completed timber harvest plan in the year 2000.

Precommercial thinning coverage
Stimson Lumber Company also developed and maintained an electronic database of silvicultural treatments and timing. The database contains a complete record of precommercial thinning (PCT) activities extending back to 1988. We updated the database attributes to incorporate timber harvest and thinning completed through the year 2000. The database does not include information on herbicide treatment and commercial thinning, nor does it contain information on precommercial thinning by Stimson prior to 1988. Uncertainties in the actual extent of thinning occur where PCT map units overlap old-growth, riparian, and hardwood-dominated stands that were clearly not intended to be thinned. These discrepancies are most likely due to field mapping and digitizing errors in the PCT coverage and were corrected by omitting the overlapping portions of the PCT polygons.

3.2.1 Vegetation management for ecological benefits

The objective of this analysis was to identify and prioritize areas where active management of second-growth conifer stands would likely accelerate development of complexity, diversity, and other ecological values associated with late-successional forests. This approach assumes that heavily stocked and homogeneous young conifer plantations will develop late-successional characteristics more quickly if initial restorative silvicultural treatments (e.g., thinning) are applied within their first 20 years of growth (Carey et al. 1998, Poage et al. 2001, USDA Forest Service 2002).

Indicators used in the analysis

Stand condition
A major objective of the Mill Creek acquisition is to restore late-successional forest characteristics to the area. Late-successional forest characteristics can be measured using many different parameters, including age distribution, tree density, species composition, structure, and complexity. In the absence of these data at the stand scale, we used stand age and thinning history as a crude proxy for developmental stage. We assigned rankings and scores to eight classes based on stand age, precommercial thinning history, and size (Figure 3-7, Table 3-11). Stands >40 years received a low ranking because they have been precommercially thinned and we assume they are beginning to develop late successional characteristics. Although these stands may benefit from restorative silvicultural treatments, they are not considered a priority for vegetation management during the interim period.

Table 3-11. Stand condition scores.

Age Class, years	Precommercial Thinning	Area	Score	Relative Ranking
0-5	-	-	0	low
6-10	-	<3 ha	2	mod-high
6-10	-	>3 ha	3	high
11-20	unthinned	<3 ha	3	high
11-20	unthinned	>3 ha	4	very high
11-20	thinned	-	0	low
21-40	-	-	1	moderate
>40	-	-	0	low

This general indicator does not incorporate many of the important attributes of late-successional forest habitat, particularly those relating to biological and structural diversity, clustering, downed wood and snags, and other decay elements. Furthermore, the indicator does not take into account site-specific conditions that influence productivity and species dominance, such as slope, aspect, soil characteristics, and microclimate.

Buffers around critical habitat and activity sites
Buffers provide a protective forested area adjacent to habitats of concern that reduces risk of windthrow, nest predation, and loss of forest interior conditions. Buffers 0.25 miles wide were delineated around suitable marbled murrelet and northern spotted owl nesting habitat, defined as old-growth stands greater than 3 hectares (based on observation made by Hamer and Nelson 1991). Prioritization of these areas assumes an optimal short-term cost-benefit for forest restoration adjacent to existing high value habitat. Buffers around spotted owl activity sites were independently scored (Tables 3-12 and 3-13).

Table 3-12. Scores for buffers around northern spotted owl and marbled murrelet habitat.

0.25 mile Buffer	Score	Relative Ranking
outside	0	low
inside	1	high

Table 3-13. Scores for buffers around northern spotted owl activity sites.

0.25 mile Buffer	Score	Relative Ranking
outside	0	low
inside	1	high

Connectivity

Values were assigned to estimate the extent to which areas surrounding old-growth forest stands may ultimately provide connectivity for old-growth associated species. Connectivity was used as an indicator by assigning point values to concentric areas radiating out from the perimeter of existing old-growth stands and groups of scattered old-growth trees greater than 3 hectares (based on observations by Hamer and Nelson 1995). Distance from the edge of the old-growth vegetation polygon was measured in 0.25-mile increments. Point values decreased for each quarter mile beyond the initial buffer (Table 3-14). Point values were assigned to each empty cell until all cells across the property were filled. Overlapping zones from adjacent stands were assigned only the highest connectivity score, not the combined scores of overlapping areas. The indicator assumes optimal long-term cost benefits from forest restoration in corridors that provide regional connectivity among existing old-growth habitat patches.

Table 3-14. Habitat connectivity scores.

Distance (mi)	Score	Relative Ranking
>0.75	0	low
0.5-0.75	1	moderate
0.25-0.5	2	high
0-0.25	3	very high

Results

Indicator scores were summed to obtain a composite score for each 10-meter grid cell (Table 3-15).

Table 3-15. Composite scores for vegetation management for ecological benefits.

Cumulative Score	Relative Ranking
0-2	low
3-4	moderate
5-6	high
7-9	very high

Composite scores were then used to prioritize areas for interim forest restoration (Figure 3-8 and 3-9, Table D-3). Very high priority areas are comprised primarily of unthinned 11 to 20 year-old stands that optimize connectivity and lie within existing old-growth habitat buffers. Approximately 16 km^2 (6.3 mi^2) were identified as having a very high priority for treatment. Very high priority stands are

Figure 3-7. Stand conditions.

Figure 3-8. Map of prioritization of vegetation management for ecological benefits.

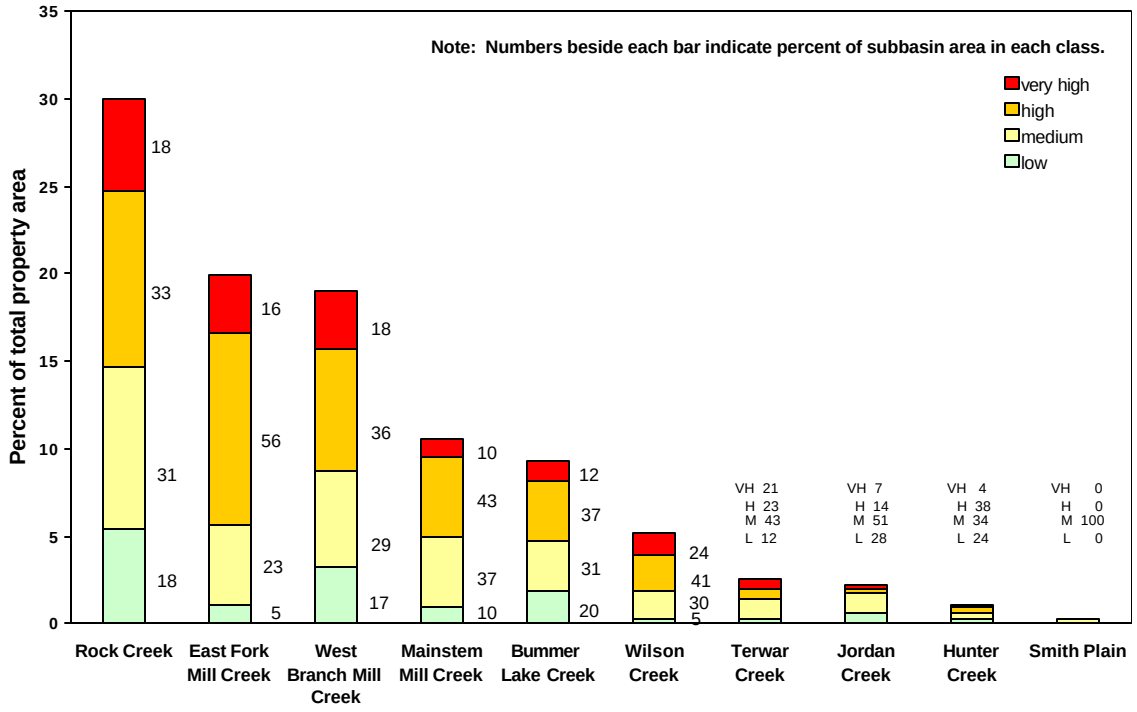


Figure 3-9. Prioritization of vegetation management for ecological benefits.

broadly distributed across the property. The largest very high priority stands occur around the Paragon old-growth stand; adjacent to the south branch of East Fork Mill Creek in the vicinity of T15N, R1E section 10; in the upper reaches of West Branch Mill Creek and Rock Creek, and where the northern property boundary borders old-growth stands in Jedediah Smith Redwoods State Park.

3.2.2 Vegetation management for fuels and fire hazard reduction

The objective of this analysis was to identify and prioritize areas where vegetation management would reduce the risk of catastrophic wildfire. Fire no longer functions as a natural disturbance agent in managed timberlands and in parks such as the Mill Creek property. Fire suppression and timber management over the last 50 years has increased the amount of surface, crown, and ladder fuels; and the risk of stand-altering fires that could affect old-growth forests on and adjacent to the property.

Indicators used in the analyses

Fuels ranking
The amount, size, and moisture content of surface fuels determine how fast a fire spreads, how hot it burns, and how high its flames reach. The California Interagency Fuel Mapping Group (CAIFMG), a consortium of State and Federal agencies, developed regional surface fuel maps for California. Surface fuel maps were developed by translating vegetation information (plant species, crown cover, and tree size) into fuel characteristics, combining them with topographic data (slope, aspect and elevation) and historical fire data, and patching them together to form a GIS fuels coverage with a 30-meter (98-foot) grid spacing. The minimum mapping unit for fuels data developed by CAIFMG ranges from 900 m^2 (9,688 ft^2) up to 100 ha (2.5 ac). CDF combined surface fuels with slope data to rank areas as low, moderate, and high. CDF uses these fuel rankings with weather data, assets at risk, and historic level of service to identify and prioritize pre-fire projects (CDF 2002).

We assigned hazard scores to each CDF fuel ranking class to analyze potential wildfire risk on the Mill Creek property (Table 3-16).

Table 3-16. Fuels ranking scores.

CDF fuel rank	Score	Relative Ranking
low	0	low
moderate	1	moderate
high	2	high

Stand condition

The fuel load and the fuel ladder on managed timberlands substantially influences fire risk at the site or stand scale. Surface fuels and ignition potential increase with age of a replanted or reseeded harvested unit. A dense, regenerating stand reaches a critical fire hazard after the first two decades of growth due to high ignition risk, high surface fuel loading, and a well-developed low fuel ladder. Thinning stands that reach this critical hazard level reduces stem density and fuel ladder development while temporarily increasing surface fuel loading and ignition potential. Thinning during this time also reduces long-term catastrophic wildfire risk by reducing long-term fuel loading and creates a microclimate less prone to ignition. For this analysis, stand age and precommercial thinning history

were used to estimate the fire risk associated with expected fuels and fuel ladder. A priority rank or hazard score was assigned to each stand condition class (Table 3-17).

Table 3-17. Stand condition scores.

Age class, years	Precommercial Thinning	Score
0-10	-	1
11-20	unthinned	3
11-20	thinned <5 years	3
11-20	thinned >5 years	2
20-100	-	1
>100	-	0

Potential sources of natural ignition

Inland ridge crests are highly susceptible to lightning strikes. Higher fire frequency in these areas is evident from fire scars on large trees and the presence of more fire-adapted vegetation types (e.g., Jeffrey pine grasslands, knobcone pine, and chaparral). Generalized ignition risk is incorporated into the fuels ranking. This regional model, however, oversimplifies topography in the Mill Creek vicinity. We used a 10-m DTM to identify ridge crest positions where lightning strikes are most likely to occur. Ridgecrest positions were defined as the upper 10% of the basin (Table 3-18).

Table 3-18. Scores for natural ignition areas.

Slope Position	Score	Relative Ranking
upper 10% and moderate or high fuels ranking	1	high
other	0	low

Buffers

Public structures and frequently used areas where anthropogenic ignition is more likely require surrounding defensible spaces for fuels and fire risk management. Only the existing buildings at the mill site currently require this defensible space. We assumed for this analysis, however, that the Stimson picnic area and main (haul) roads will become potential sources of anthropogenic ignition and may require similar defensible space. To account for potential ignition and defensible space, 100-m-(328 ft-) wide buffers were placed around the mill site, picnic site, and adjacent to primary road network. We also considered the potential need to control the spread of fire to and from adjacent parcels by delineating a 100 m-(328 ft-) wide buffer along the interior of the property boundary.

Table 3-19. Scores for fire management buffers.

Fire management buffer	Score	Relative Ranking
inside	1	high
outside	0	low

Results

Indicator scores were summed to obtain a composite score for each 10-meter (33-foot) grid cell (Table 3-20).

Table 3-20. Composite scores for vegetation management for fuels and fire hazard reduction.

Cumulative Score	Relative Ranking
0-2	low
3	moderate
4	high
5-7	very high

Composite scores were then used to prioritize areas for silvicultural treatment to reduce fuels and fire hazard (Figure 3-10, Figure 3-11, Table D-4). Very high priority areas are comprised primarily of unthinned 11 to 20 year-old stands that occur within fire management buffers in upper basin positions with a high risk of natural ignition. Approximately 17.1 km^2 (6.6 mi^2) were identified as having a very high priority for treatment. The distribution of stands with a high priority for fuels and fire hazard reduction is similar to the distribution of stands with a high priority for forest restoration. Approximately 7.5 km^2 (2.9 mi^2) received a very high priority for both forest restoration and fire hazard reduction.

3.2.3 Control of plant pathogens and pests

Several plant pathogens and pests present potential risks to forests on the Mill Creek property, including Sudden Oak death (SOD)(*Phytophthora ramorum*), Port Orford cedar (POC) root disease (*Phytophthora lateralis*), and several species of bark beetles (*Dendroctonus* spp.) Refer to section 2.8.5 for a thorough description of these pathogens.

POC is located throughout the property in mixed stands with redwood, western red cedar, and Douglas fir. There is no existing mapping of POC distribution on the Mill Creek property, and until May 2002, Port Orford cedar root disease had not been documented on the property. Dispersal of POC root disease to the property from surrounding areas was probably limited by Stimson's use of predominantly on-site equipment for timber and road management. Specialists with the Forest Service identified seedling and sapling trees exhibiting signs of *Phytophthora lateralis* infection on the road fill above two stream crossings in the upper Bummer Lake Creek basin (Figure 3-12) (V. Gizinski,

Figure 3-10. Map of prioritization of vegetation management for fuels and fire hazard reduction.

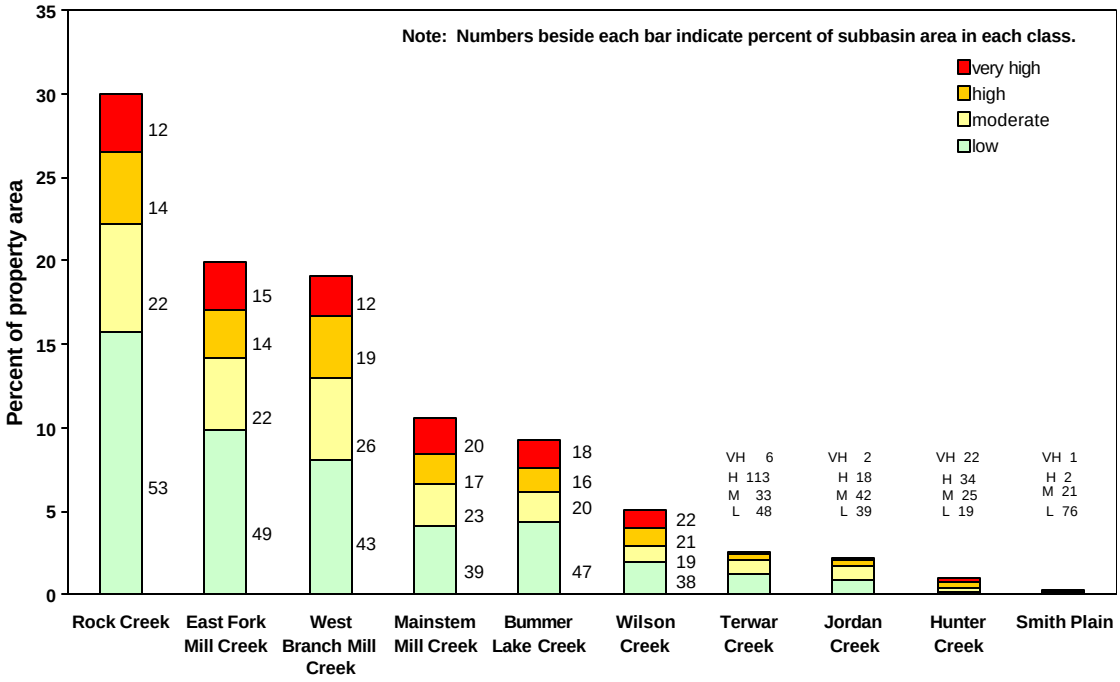


Figure 3-11. Prioritization of vegetation management for fuels and fire hazard reduction.

pers. comm., 2002). POC root disease may be dispersed by transporting contaminated plant parts, soil, and sediments. The main pathways for dispersal are road and stream networks. We identified roads, streams, and trails that intersected the two affected areas so that actions can be taken to minimize disease dispersal (Figure 3-12). Additional areas should be identified for closure and treatment when information on the extent of host vegetation and pathogen occurrence on the property become available.

3.3 Aquatic and Terrestrial Habitat Protection and Enhancement

The location and habitat diversity of the Mill Creek property provides opportunities to protect and enhance fish and wildlife habitat. Despite more than a century of commercial timber management, the property continues to harbor old-growth forests and old-growth dependent species. Long-term restoration of late-successional forest conditions will benefit these and many other species. Connectivity of old-growth stands within and beyond the property should improve as forests mature. Important habitat features such as snags, downed wood, and cavities should become more abundant and provide breeding, foraging, and cover habitats for many terrestrial species.

Protecting important fish and wildlife habitats and identifying areas most suitable for habitat restoration are high priorities for interim management of the Mill Creek property. We identified existing habitat suitable for species of concern and delineated management zones around these habitats. These management zones provide an overlay for identifying (1) limitations on the timing of public use and implementation of management programs, and (2) early-successional habitats where forest restoration would provide optimal short-term cost-benefit due to its proximity to existing high value habitat (refer to Section 3.2.1).

3.3.1 Aquatic and riparian habitat protection areas

The Mill Creek property contains habitat for state and federally listed or proposed aquatic species, including coho salmon (*Oncorhynchus kisutch*) and steelhead (*O. mykiss*) (refer to section 2.10). Coho salmon are listed as threatened in the Southern Oregon/Northern California Coasts ESU and are candidate for listing by the state of California. Steelhead have been proposed for listing in the Klamath Mountains Province ESU. Chinook salmon, coastal cutthroat trout, and Pacific lamprey are also species of concern that utilize habitat similar to the state and federally listed species. Protection of aquatic and riparian habitats can be achieved, at least in part, through delineation of special management areas around streams that provide essential aquatic ecosystem functions (FEMAT 1993). We delineated a 91-m (300-ft) buffer around Class I and Class II watercourses as defined by the California Forest Practice Rules. Class I watercourses include streams (perennial or seasonal) that provide fish habitat or are within 305 m (1,000 ft) of a domestic water source. Class II watercourses provide habitat for non-fish aquatic species and can be ephemeral. Class III watercourses, by definition, do not support aquatic organisms and were not mapped by Stimson, thus were not afforded specific protection areas for the purpose of this analysis.

3.3.2 Terrestrial habitat protection areas

The Mill Creek property also contains habitat for the federally endangered marbled murrelet (*Brachyramphus marmoratus*) and federally threatened northern spotted owl (*Strix occidentalis caurina*) (refer to section 2.11). Surveys have confirmed the presence of northern spotted owls and nesting of marbled murrelets on the Mill Creek property. A database of suitable marbled murrelet

habitat and northern spotted owl activity sites was developed by Stimson Lumber Company during their HCP planning process (Stimson Lumber Company 1998). The database requires updating to include land use changes and new habitat definitions. For this analysis, all past and present spotted owl activity sites in the Stimson database received a 0.4 km- (0.25 mi)-wide buffer in order to give priority to old-growth stands and scattered old-growth residuals that have served as nesting habitat. A 0.4 km-(0.25 mi)-wide buffer was delineated around all suitable marbled murrelet nesting habitat, defined as old-growth forest stands greater than 3 ha (7.4 ac). A 0.4 km- (0.25 mi)-wide buffer was also delineated along the property boundary where old-growth forests occur immediately adjacent to the Mill Creek property.

3.4 Access and Use

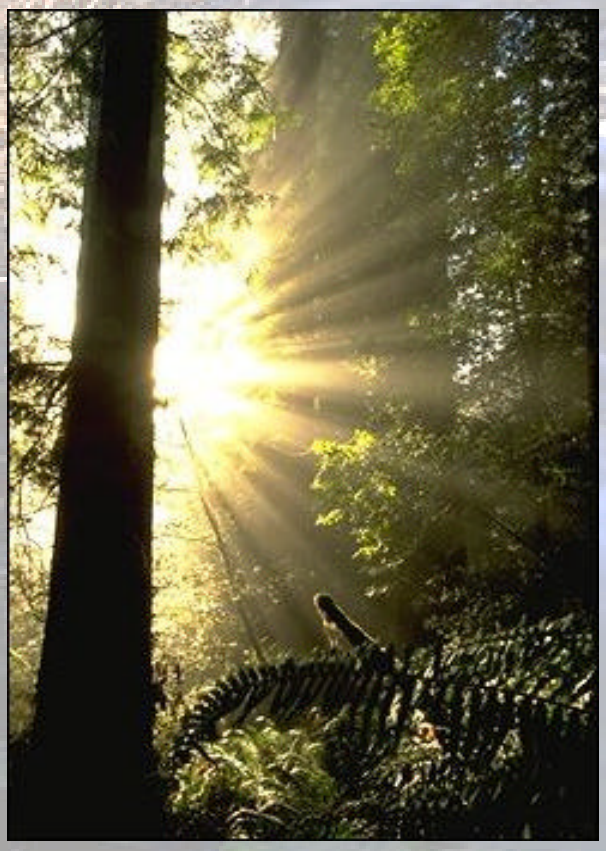
The Mill Creek property offers many opportunities for non-consumptive public recreational use consistent with the goals of restoring old-growth forest ecological functions. The objectives of the interim management plan are to identify suitable areas for initial public access based on (1) existing infrastructure; (2) road, forest, and fish and wildlife analyses conducted above; and (3) coordination with DPR, resource agencies, and the public.

Recreational opportunities during the interim period include day-use activities (e.g., hiking, biking, fishing, and horse riding) that utilize existing facilities and the existing road network. Several regional trails on adjacent public lands could be connected to the property during the interim period using the existing road network. Additional near-term outreach, education, and research opportunities could be realized through adaptive re-use of existing buildings at the old mill site. Constraints to public access in the interim include fish and wildlife habitat protection, road management, and containment of forest pathogens.

Figure 3-12. Map of areas potentially affected by Port-Orford cedar root disease.

Chapter 4

Recommendations



4 RECOMMENDATIONS

The analyses described in Section 3 identified areas with a high risk of erosion (Figure 3-2), road-stream crossing failure (Figure 3-5), and log landing erosion (Figure 3-6); areas where management of young stands could accelerate restoration of old-growth forest characteristics (Figure 3-9) and reduce high fire risk (Figure 3-10); and important habitat management areas. The following section describes (1) desired future conditions, (2) recommended actions, (3) potential adverse impacts, and (4) potential mitigation measures for each of the priority issues, including road management, vegetation management, aquatic and terrestrial habitat protection and enhancement, and public access and use.

The management recommendations described below were developed by synthesizing these results with additional input from working groups, DPR, and the public. High priority should be given to implementing interim management actions that provide multiple benefits. Research and monitoring should be integrated parts of a systematic process for (1) developing working hypotheses for management actions, (2) predicting and evaluating response to management activities, (3) expanding the database that will eventually support the General Planning process, and (4) adapting future management actions to more effectively achieve desired future conditions.

4.1 Road Management

Because the existing road system will no longer be utilized for commercial timber management, many secondary roads on the property will become an unnecessary liability to DPR. Without continued maintenance and upgrade or decommissioning of the existing road network, the risk of chronic and episodic erosion will increase dramatically. Increased erosion and sediment delivery to stream channels would degrade water quality and aquatic habitat, including critical habitat for state and federally listed anadromous salmonids. The dense road network will continue to negatively impact terrestrial habitat through habitat fragmentation, artificial migration barriers, and vectors for exotic species. Developing a comprehensive road management plan is the first critical step in minimizing the risk of road-related impacts on the Mill Creek property. Developing this plan may require several years to secure funding, conduct background studies, and determine an optimal design of a permanent road network. In the interim period, existing roads must be maintained and modified to minimize adverse environmental impacts.

Rock Creek is a high priority subwatershed for road management based on a very high density of roads with large numbers of high risk road-stream crossings and large, potentially unstable log landings located on potentially unstable slopes. Rock Creek also experienced rapid rates of timber harvest during the 1990's which may have preconditioned slopes to increased instability in the event of a future large storm event. Furthermore, the inland and drier forests of the Rock Creek basin contain very high surface fuel loads and continuous low crown ladders that are susceptible to large catastrophic wildfire (Figure 3-10). Wildfire could further increase the risk of catastrophic erosion during subsequent large storms. The high gradient and coarse substrate of aquatic habitat in Rock Creek, however, is less suitable for federally listed coho salmon. The potential ecological impacts of erosion may be less severe than in adjacent Mill Creek subbasins with lower erosion risk but higher coho habitat value, closer proximity to old-growth forest stands, and greater opportunity for interim public use. Several priority areas are identified in the East Fork Mill Creek, West Branch Mill Creek, and Bummer Lake Creek basins based on concentrations of high risk crossings and road segments located on or directly above steep and potentially unstable slopes. Specific priority areas in Mill Creek subbasins include:

East Fork Mill Creek
NE 1/4 section 11, T15N, R1E
SE 1/4 section 3, T15N, R1E
E 1/2 section 8, T15N, R1E

West Branch Mill Creek
Section 16, T15N, R1E
NW 1/4 section 20, T15N, R1E
NE1/4 section 21, T15N, R1E

Bummer Lake Creek
Section 28, T16N, R1E

Rock Creek basin with Rattlesnake Ridge in the background (taken looking east from the northeast ¼ of section 23, T15N, R1E).

4.1.1 Desired future conditions

A permanent road network should be identified to maximize long-term resource protection while providing access for resource enhancement, forest restoration, fuels and fire management, appropriate public recreation, and environmental monitoring. The road network should be designed to minimize fine and coarse sediment delivery to stream channels and be as hydrologically disconnected from the stream channel network as possible. Roads should be retained only where necessary to minimize overall road density and maintenance costs. Non-essential roads should be systematically decommissioned to allow thorough treatment of adjacent contributing drainage areas and access for forest and fire management activities. A research framework should be developed to monitor the effects of road management activities. The framework should be part of a comprehensive watershed management strategy that guides long-term adaptive management.

4.1.2 Recommended actions

Regulate road use

The existing road network on the Mill Creek property is comprised of 410 km (255 mi) of road within a 104 km^2 (40 mi^2) area. Public motorized vehicular access should initially be limited to the 8.2-km (5.1-mi) segment of Hamilton Road connecting Highway 101 and the mill site. Additional public motorized vehicular access should be considered between the mill site and potential public use sites located along Childs Hill Road at (1) the junction of Rock Creek Road and (2) at the East Fork Mill Creek crossing near the center of T15N, R1E Section 3. Gates or other movable barriers should be installed to temporarily restrict public motorized vehicular access to all other primary and secondary roads originating from Hamilton and Childs Hill roads between Highway 101 and these two public destination points. Primary and secondary roads beyond these two public destination points could be utilized for pedestrian, equestrian, and bicycle use. Authorized backcountry road use should follow the policies developed by DPR.

Inventory and establish treatment priorities for existing roads and log landings

A comprehensive field inventory of existing road conditions (maintained and abandoned) is necessary to identify past and potential future contributions of sediment to stream channels in order to minimize potential negative impacts to water quality and aquatic habitat. The basic strategy and methods for inventorying roads are described in Weaver and Hagans (1994) and Weaver (1997). If financial resources are not available for a comprehensive inventory during the summer and fall of 2002, we strongly recommend that an initial reconnaissance inventory be conducted during this period and a more comprehensive inventory be conducted during the summer of 2003, or as soon as possible thereafter.

A reconnaissance inventory of all high and very high-risk road segments, log landings, and road-stream crossings must be conducted during the summer of 2002 to prepare for the 2002/2003 storm season. The primary goal of this assessment is to prioritize treatment of high risk log landings; road segments; and road-stream crossings with high potential for erosion, plugging, and diversion. The assessment should specifically address:

- sites that require maintenance prior to the 2002/2003 rainy season,
- sites that will require monitoring during the rainy season,
- log landings that require removal of unstable side-cast fill, and
- road segments and stream crossings that require immediate upgrading or stormproofing to reduce sediment delivery to stream channels.

A comprehensive assessment of all roads (active and abandoned) and watershed geomorphic conditions should be conducted thereafter to:

- inventory existing and potential future sediment sources likely to deliver sediment to the channel network,
- quantify road maintenance and repair needs,
- develop priorities and prescriptions for log landings and road treatment based on potential future sediment yield to stream channels, accessibility, and treatment immediacy, and
- design a permanent road network that maximizes long-term resource protection, minimizes routine maintenance, and provides appropriate public and administrative access.

Develop an inspection and maintenance schedule

Regular road maintenance is essential to ensure that roads and road-stream crossings function properly. A culvert blocked by woody debris or sediment may cause streamflow to overtop the headwall and erode crossing fill or divert over and down the road surface instead of into the natural drainage channel. Roads and drainage structures along all permanent, seasonal, and temporary roads should be inspected annually prior to the beginning of the rainy season. Additional inspection and emergency maintenance is necessary during and following each winter storm of one inch or more, particularly in high-risk areas where multiple crossings occur on a stream. These inspections should include assessing the conditions of culvert inlets and outlets, inboard ditches and ditch relief structures, cutbanks and fillslopes, waterbars, and other erosion control features. We recommend that all essential equipment be stored onsite to ensure rapid response during winter storm periods, and to limit the dispersal of plant pathogens to and from the Mill Creek property.

Upgrade and stormproof roads with high erosion risk

Road segments and road-stream crossings with high and very high erosion risk should be treated prior to the next large storm event to minimize the potential for significant impacts to aquatic resources. Many of the very high-risk road and stream crossing sites are located along primary (mainline) roads that will receive frequent vehicle use by park personnel and will be needed to access large areas of the property for managing roads and other resources. All primary roads that will receive continued use should be

evaluated to determine where upgrades and road reconstruction would effectively minimize erosion potential, diversion potential, and maintenance requirements. Potential treatments include:

- upgrading culverts to pass wood, water, and sediment during a 100-year flow event;
- constructing critical dips at crossings with high potential for plugging and diversion;
- constructing waterbars and ditch relief culverts that discharge to vegetation filters; and
- localized outsloping of the road surface.

Secondary (spur) roads that will be used infrequently and have potential to deliver sediment to stream channels should be "stormproofed" as soon as possible. The goal of road stormproofing is to reduce the erosion and stream diversion potential and minimize maintenance requirements. Only those road segments with the potential to erode and generate sediment to stream channels should be treated. Road segments that pose no risk of sediment delivery should receive only drainage improvements. High priority sites should be treated first, followed by all other sites with potential to deliver sediment. Roads that require infrequent use for forest restoration activities should be temporarily decommissioned by applying stormproofing measures as well as removing culverts and crossing fill material. Typical stormproofing measures include:

- culvert installation, upgrading, and cleaning;
- waterbar and cross-road drain installation;
- ripping or decompaction of road surfaces;
- rolling dip (critical dip) construction;
- outsloping; and
- stream crossing excavation.

Some stormproofing measures (e.g., ripping, waterbars, outsloping) may increase fill failure potential and exacerbate erosion by increasing saturation of side-cast fill or by routing water to the skid trail network. Detailed geomorphic field mapping should be completed at a site before stormproofing measures are implemented.

Our analyses prioritized specific road segments, road-stream crossings, and log landings with the highest risk of delivering sediment to streams (Figure 4-1). We identified roads with a high concentration of very high-risk crossings and a substantial (>50%) length of high to very high erosion hazard. A total of 104 km (65 mi) of high-priority secondary (spur) roads encompassing 180 stream crossings and approximately 51,530 m^3 (67,400 yd^3) of potentially erodible material were identified for stormproofing and/or decommissioning during the interim period. A limited number of very high-risk secondary road segments and stream crossings are widely scattered throughout the basin but were not prioritized for initial treatment because the remaining portions of these roads had low erosion risk or low potential to deliver sediment to stream channels. Nevertheless, the failure of a single high-risk crossing or road segment can result in more damage than an area with a high concentration of potentially hazardous sites. Scattered high priority sites should be assessed as soon as possible.

At least two existing crossings may block fish passage: the Childs Hill crossing of Powderhouse Creek (NE ¼ Section 5 T15N,R1E) and the West Branch Road crossing of a third-order tributary to the South Fork of East Branch Mill Creek (NE ¼ Section 8 T15N,R1E) (Figure 3-5). These culverts should be evaluated to determine the extent to which they are barriers to fish movement and the amount of habitat located above the crossings that may presently be inaccessible.

Figure 4-1. Priority roads, road-stream crossings, and log landings.

Inspect and upgrade primary public access roads to State Park destination points

Hamilton Road is the primary road providing access to the property and the most suitable road for providing public access to the future State Park. Most of the 8.2-km (5.1 mi) road between Highway 101 and the mill site is paved. In November 1998, a bridge and portions of the roadbed between the main gate and West Branch Mill Creek failed. Approximately 0.5 km (0.3 mi) of road was rerouted to the left bank of Hamilton Creek and surfaced with crushed rock. A certified engineering geologist should assess the long-term stability of Hamilton Road between the main gate and the West Branch Mill Creek. If it is determined that the present alignment is the best long-term location for the main access road, the section that is currently surfaced with rock should be paved to minimize long-term maintenance requirements. If not, a new road alignment should be identified.

A large, flat area located on a low terrace of West Branch Mill Creek was used by Stimson Lumber Company as a picnic area and could serve as a group camp or meeting place. Picnic Road, the primary access road to the picnic site, could also link Hamilton Road to the existing Mill Creek Campground. Picnic Road, however, is a valley bottom road that locally confines the West Branch Mill Creek, has a number of potential hillslope instability and road drainage problems, and would require construction of a bridge over West Branch Mill Creek to allow through-traffic between State Park facilities. A certified engineering geologist should evaluate the feasibility of this road for public use. If the road is determined unsuitable, it should be stabilized and converted to a trail linking the two State Park facilities.

Decommission non-essential roads and treat associated hillslope erosion

Log landings, road segments, and road-stream crossings with high and very high erosion risk should be treated prior to the next large storm event to minimize the potential for significant impacts to aquatic resources. Decommissioning of all non-essential roads should occur as soon as DPR delineates a permanent road network, prioritizes roads for treatment, and formulates cost-effective treatment prescriptions. Our analyses identified a total of 104 km (65 mi) of high-priority roads encompassing 180 stream crossings and approximately 51,530 m^3 (67,400 yd^3) of potentially erodible material (Figure 4-1, Table 4-1). Roads situated within valley bottom riparian areas, old-growth stands, and other sensitive areas described in section 4.3.2 should also be considered for closure or decommissioning. Roads recommended for decommissioning may require stormproofing and other preventative treatments prior to decommissioning.

Develop long-term road management plan

A comprehensive road management plan should be developed concurrently with long-term forest restoration, fire management, and recreational use plans. Road treatments should be part of a systematic watershed rehabilitation program that addresses all sediment sources associated with active and abandoned roads, including road crossings, log landings, and other sediment sources related to altered landforms and drainage. The long-term road management plan should stage road removal to allow thorough treatment of upper basin areas and the outer limits of the road network before moving downslope or to more intermediate road positions.

Table 4-1. Summary of high-risk roads recommended for treatment to reduce erosion and diversion potential.

Road	Map Number	Subwatershed	Total Length Recommended for Treatment (mi)	Number of Stream Crossings	Potential Erosion Volume Removed by Excavating Stream Crossings[1] (yd^3)
Smokehouse Road	1	Bummer Lake Creek	6.0	27	14515
Fourth Switchback	2	Rock	2.4	11	6899
First Switchback	3	Rock	2.6	6	5779
Section 1 Road	4	East Fork Mill	24.4	15	4932
Airport Spur	5	Rock	1.8	6	4910
Boulder Avenue	6	Rock	2.2	9	3828
Teran Road	7	Mainstem Mill	2.3	10	3794
Ray Smith Road	8	East Fork Mill	2.4	7	3329
Section 36 Road	9	East Fork Mill	1.0	9	2987
Unnamed	10	West Branch Mill	1.1	7	2934
Crossover Spur	11	East Fork Mill	2.9	13	2750
Wilbur Spur	12	Rock	0.9	4	2364
AJ-1	13	East Fork Mill / Rock	1.9	6	2238
Dry Lake Road	14	Rock	1.8	6	1693
Howard Spur	15	Rock	2.3	8	1037
P-J Spur	16	East Fork Mill	1.9	6	871
Low Divide	17	East Fork Mill	2.5	9	813
Park Spur	18	West Branch Mill	1.5	8	630
Section 5 Road	19	East Fork Mill	1.0	5	537
Westside Spur	20	East Fork Mill	1.8	8	535
Total			**65**	**180**	**67,375**

[1] Estimates of potential erosion volume at crossings is based on 1995-1997 inventories conducted by PCFWWRA and PWA.

Limit access to areas affected by plant pathogens

Seasonal road and area closures should be implemented to prevent the spread of POC root disease and SOD. Smokehouse Road, the only road that accesses the two sites suspected of POC root disease infection in the Bummer Lake Creek basin, received a high priority for treatment based on both erosion and stream crossing risks (Figures 4-1 and 3-11). This 9.7-km (6 mi) secondary road has 27 stream crossings and a total potential erosion volume of 11,100 (14,515 yd^3). This road should be considered for decommissioning to minimize both potential future erosion and the spread of POC root disease. Refer to section 4.2.2 for recommendations to limit the spread of plant pathogens from infected areas.

Research and Monitoring

The Mill Creek property provides an excellent opportunity to gather baseline data then monitor the effectiveness of road management and restoration activities over time. A comprehensive watershed monitoring strategy should be developed that identifies goals and critical assumptions, establishes parameters, guides collection and storage of data, and is used to predict and evaluate landscape response to management activities. Specific recommendations for research and monitoring related to the road network include:

- developing a database of road maintenance and treatment history that can be used to prioritize future road treatments and refine road maintenance schedules;
- establishing continuous gaging stations for measuring precipitation, streamflow, and sediment discharge throughout the Mill Creek and Rock Creek watersheds;
- long-term monitoring of channel response to large floods, legacy land use, and management activities;
- hillslope monitoring to evaluate erosion processes and sediment yield in different managed and unmanaged settings;
- trend monitoring to evaluate long-term, watershed-scale effects of road management activities compared to regional trends;
- validation of hillslope instability and erosion risk models;
- field assessment of long-term sediment budgets for areas with contrasting geology, road density, and degree of road removal; and
- monitoring fish passage at culverts and field validation of existing fish passage models (e.g., FishXing [USDA Forest Service 1998]).

4.1.3 Potential adverse impacts

The following potential adverse impacts may result from the recommended management actions.

- Road maintenance and treatment may temporarily increase fine sediment delivery to stream channels, resulting in short-term impacts to aquatic resources.
- Road maintenance and treatment may result in temporary disturbance to terrestrial wildlife species.
- The ongoing presence of a road system will affect terrestrial and aquatic ecosystems through edge effects (e.g., nest predation, microclimate influences) and reduced habitat connectivity for species with low vagility.
- Illegal use of restricted roads and the use of off-road vehicles may adversely impact both roads and sensitive wildlife species and their habitats.

4.1.4 Potential mitigation measures

The following mitigation measures may be useful for reducing the impacts described above.

- Conduct road maintenance and treatment (i.e., construction, reconstruction, upgrading, rocking, or mechanical site preparation) during the dry season.
- Minimize ground disturbance during roadwork.
- Protect bare slopes associated with road work from surface erosion by applying certified weed-free mulch; seeding or planting native species; or armoring as soon as possible, and at a minimum, prior to the following wet season.
- Utilize silt fences and/or straw bale dams to limit sediment delivery to stream channels during road management activities.
- Restrict the timing and area of road management activities to reduce impacts on nesting birds or other sensitive species.
- Reduce road widths on retained roads.

4.2 Vegetation Management


Sunset over coniferous forest stand on the Mill Creek property.

The Mill Creek property once supported a structurally and biologically diverse patchwork of early to late-successional Pacific Northwest coniferous forest. After nearly a century of commercial timber management and fire suppression, forests on the Mill Creek property are now dominantly comprised of dense, even-aged, second-growth conifer plantations with limited structural and biological diversity. One of the primary goals of the property acquisition is to protect existing old-growth stands and restore late-successional characteristics to these young conifer forests. Opportunities to restore late-successional forest characteristics may be severely constrained if young conifer plantations are not actively managed during the interim period. Lack of active forest management may result in stand decadence due to overcrowded conditions; reduced forest health and vigor through reduced crown ratios; little canopy stratification and understory development, greater susceptibility to windthrow; and increased risk of catastrophic wildfire associated with high fuel loading.

4.2.1 Desired future conditions

Desired future conditions for the Mill Creek property include protecting and enhancing unique plants and vegetation communities, controlling the spread of introduced plants and plant pathogens, and restoring late-successional forest characteristics to young second-growth conifer plantations. Major structural attributes of late-successional forests include large living trees; large standing dead or decaying trees; and large downed wood on hillslopes, in riparian areas, and in stream channels. Other characteristics include multiple canopy layers, canopy gaps, and patchy understory vegetation. Late-successional forests perform numerous ecological functions that are not well developed in younger, even-aged forests. These functions include creating a microclimate that buffers seasonal climatic extremes, providing habitat for species uniquely adapted to conditions found in these forests, and storing substantial amounts of carbon. Late-successional forests retain nutrients for longer periods and have low soil erosion potential. A multi-layered forest canopy with a shade-tolerant shrub- and tree-dominated understory provides food and structurally complex habitat for many organisms. Old-growth forests are also typically more resistant to catastrophic stand-replacing fires. Densely forested headwater regions supply large woody debris and sediment to the channel network, creating valuable aquatic habitat in downstream reaches. Late-successional riparian areas limit bank erosion, contribute large stable pieces of woody debris to stream channels, and strongly influence microclimate in riparian corridors. Enhancing connectivity of old-growth stands on both watershed and larger scales will foster long-term regional viability of old-growth-associated plant and animal populations.


Old-growth forest with understory on the Mill Creek property.

4.2.2 Recommended actions

Conduct field surveys
Field surveys should begin as soon as possible to:

- verify the results of the vegetation analyses,
- document stand conditions in high-priority areas, and
- identify rare or endangered plants prior to implementing site-specific recommendations.

The analysis in Section 3.2.1 relies on general relationships between stand age and potential habitat characteristics based on modeling of even-age timber stands. The actual habitat provided by existing stands is poorly understood. Stand inventories should be conducted in areas most likely to provide ecological benefits and fire hazard reduction benefits during the interim period (Figure 3-8, Figure 3-10). We recommend using a stratified random sampling protocol for stand inventories, with sampling units stratified by watershed, vegetation type, and stand age. Stand inventories should include assessments of ecologically important forest components such as species composition, crown ratios, degree of crown stratification, snags and downed wood by size and decay class, and residual trees and their characteristics. Fuel loading and ladders should also be assessed during stand inventory. A system of permanent vegetation plots should be established for long-term monitoring.

Future management activities will require information on the presence of rare or endangered plants. Surveys to date do not cover the entire property and may not have been conducted during the times necessary to identify some species. Site-specific plant surveys should be conducted to document presence, site conditions, structure, and composition of special plant communities and special-status plants prior to implementation of site-specific projects. In the long term, plant surveys are needed to determine the presence of rare, endangered, and threatened plant species across the entire property. Property-wide mapping should focus on identifying the presence and conditions associated with high diversity, endemism, or special-status plant species. Areas that have experienced little or no timber harvest may support plant species that have not been recorded on the property.

Restore second-growth forests
A long-term forest restoration plan should be developed that identifies sites and silvicultural prescriptions to achieve desired future conditions in young second-growth conifer plantations on the Mill Creek property. Section 3.2 identified high-priority areas where vegetation management could be used in the interim to accelerate development of late-successional forest characteristics in young second-growth conifer stands. Approximately 16 km^2 (6 mi^2) were identified as having high priority for management to accelerate development of late-successional forest characteristics (Figure 3-9). Areas identified as high priority for managing for ecological benefits included: (1) upper West Branch of Mill Creek, (2) East Branch of Mill Creek (particularly young stands adjacent to the Paragon old-growth stand), (3) upper Bummer Lake Creek, and (4) the eastern portion of the Rock Creek watershed. Approximately 7.5 km^2 (2.9 mi^2) received high priority for managing for both ecological benefits and fire hazard reduction (Figure 4-2).

Variable density thinning of young second-growth conifer stands could be used to decrease stem density, open the canopy, increase tree growth, encourage growth of understory vegetation, and in the long term, accelerate development of a structurally and biologically diverse forest. Dense young stands adjacent to existing old-growth received a high priority for restorative silvicultural treatments because these areas have a greater potential for improving habitat in the vicinity of nesting northern spotted owls and marbled murrelets (C. Howard, pers. comm., 2002, K. Hoffman, pers. comm., 2002). Priority should be given to areas that could serve as important movement corridors between existing old-growth stands within and beyond the property boundaries. Thinning of any specific stand will require detailed field assessment of

stand characteristics, presence of special species (unique, rare, or endangered), site conditions (e.g., soils, microclimate, slope, aspect), and slope stability prior to development of forest restoration prescriptions. Forest restoration within 0.25 mi of suitable northern spotted owl and marbled murrelet habitat should follow the recommendations described in Section 4.3.2. Silvicultural prescriptions should take into account the potential effects of thinning on adjacent microclimates and wind exposure. Areas proposed for second-growth vegetation management should be evaluated by a certified engineering geologist (CEG) for slope stability.

Reduce fuels and fire hazard in second-growth forests

A long-term fuels and wildfire management plan should be developed that identifies equipment and staffing needs, infrastructure and public use areas requiring defensible space, areas and procedures for seasonal closure, fire watch routes and firefighting procedures, and a program to reduce fuels. The natural fire regime strongly influenced the structure, composition, and distribution of vegetation; as well as the accumulation of fuels and the fuel ladder on the Mill Creek property. Fire suppression during the last century has dramatically increased the risk of catastrophic wildfire by allowing fuels to accumulate and continuous crown conditions to develop. Redwood National and State Parks and other federal forest land managers are using restorative silvicultural treatments and prescribed burning as tools for fuels management and forest restoration (Thornburgh et al. 2000). Three objectives are established for fuels reduction programs in the Wildfire Management Planning Guidelines and Policy for California State Parks (Bakken 2002): (1) reduce the probability that a fire will ignite, (2) reduce the chances that a fire will spread, and (3) facilitate fire fighting.

Variable density thinning of young second-growth conifer stands to decrease stem density, open the canopy, and increase tree growth would reduce fire risks by reducing surface, crown, and ladder fuels. Approximately 17 km^2 (6.6 mi^2) were identified as having high priority for vegetation management to reduce wildfire risk (Figure 3-10). Approximately 7.5 km^2 (2.9 mi^2) received high priority for managing for both fuels reduction and ecological benefits (Figure 4-2). Young stands adjacent to existing old-growth (e.g., young stands adjacent to the Paragon stand) received a high priority for restorative silvicultural treatments because these areas have a greater risk of transmitting wildfire to important existing old-growth and late-successional habitat. Much of the northern property boundary also has a high fire risk associated with dense, young stands in close proximity to old-growth redwood stands in Jedediah Smith Redwoods State Park. High priority areas that require access using roads with high erosion risk should be treated first so that those roads can be treated as soon as possible there after. Shaded fuel breaks on ridge tops and slope breaks could also be used to create defensible fire lines and promote late seral stand characteristics. Long-term planning should also consider appropriate fuel breaks around public use areas, high-use roads, and adjacent to neighboring commercial timberlands to minimize the risk of fire spreading to and from those properties. Fuel management zones should be reanalyzed once a permanent road network is established.

Prescribed burning is another large-scale, cost-effective fuel modification technique applied on State Park wildlands to achieve forest restoration and reduce wildfire hazards (Bakken 2002, Sawyer et al. 2000, Thornburgh et al. 2000). Controlled burning cannot occur on the Mill Creek parcel, however, until shaded fuel breaks are established and high fuel loads and fuel ladders are reduced through vegetation management practices or natural stand replacing events.

Control the spread of plant pathogens

Port Orford cedar is located throughout the property in mixed stands with redwood, western red cedar, and Douglas fir. POC root disease is suspected near two stream crossings in the upper Bummer Lake Creek basin (Figure 3-12) (V. Gizinski, pers. comm., 2002). We identified roads, streams, and trails that intersected the two areas suspected of POC infection so that actions can be taken to minimize disease dispersal. Potential pathways for disease transmission from the infected areas in the upper Bummer Lake

Figure 4-2. Priority vegetation management areas.

Creek basin include (1) tributaries draining from the infected sites to Bummer Lake Creek and (2) roads and trails intersecting the infected sites (Figure 3-11). We recommend restricting all access to areas infected by Port Orford cedar root disease, particularly during wet winter conditions. Stimson Lumber Company has already decommissioned the road west of Bummer Lake Creek. We recommend restricting all access to Teran Road, the only other road that intersects the infected area. In addition, we recommend the following best management practices to prevent the spread of POC root disease and SOD on the Mill Creek property (USDA Forest Service 1995, COMTF 2001).

- Travel between affected and unaffected areas should be avoided or minimized.
- Motorized vehicle, equestrian, pedestrian, and mountain bike access to affected areas should be limited to the dry period (June 1 through September 30).
- Footwear, vehicles, heavy equipment, equipment used for vegetation trimming or removal (brush mowers, side mount mowers, brush rakes, etc.), and other items that could accumulate soil from the diseased area should be cleaned and washed before traveling to a disease-free area. Washing areas should be located at contained, internally drained sites capable of periodic chemical disinfection. Tools and equipment that are used to prune, cut, or chip diseased trees should be disinfected by applying a liberal amount of Lysol, a 70% or higher solution of alcohol, or a 10% solution of industrial bleach.
- Water for fire suppression or dust abatement should not be taken from affected areas.
- Remove diseased vegetation from areas adjacent to roads and streams; and avoid planting host vegetation within 50 ft from roads, streams, or wet areas.
- Diseased wood should not be transported to disease-free areas.

There is an immediate need for mapping of the location of plant pathogens and host vegetation across the entire Mill Creek property. Surveys should include the occurrence of Port Orford cedar root disease and other potential plant pests or pathogens of concern on the Mill Creek property, such as sudden oak death and bark beetle infections. Six Rivers National Forest is currently mapping the distribution of POC on RNSP lands and inland forests, including the Mill Creek property. Aerial surveys to identify sudden oak death infection in north coastal basins are also in progress. The final products from these projects are expected to be available in the summer of 2002, including GIS coverages of disease distribution, host areas, and potential risk.

Additional areas should be identified for closure and treatment when information on the extent of host vegetation and pathogen occurrence on the property becomes available. Permanent monitoring should be initiated in infected areas to assess changes in the distribution of infection and the effectiveness of management activities. Strategies to prevent the spread of plant pathogens should be coordinated among DPR and adjacent property owners. In addition, the public should be educated about the potential effects of plant pathogens and their spread.

Research, Monitoring and Adaptive Management

Development of a hypothesis-driven research framework to direct monitoring and adaptive management should be used to address many of the uncertainties associated with forest restoration. DPR should actively cultivate research on the effectiveness of various methods of accelerating the recovery of late-successional characteristics in second-growth forests. Experimental plots and control stands should be established to evaluate the effectiveness of different management treatments on stand components of interest such as fuel load, stand diversity, canopy development, crown structure, structural complexity, and understory development. In addition, we suggest monitoring stands for use by species of concern.

Landscape-scale monitoring of forest structure and composition should include assessment of diversity of tree ages, the distribution and extent of desired late-successional stands, and sizes and distribution of

forest gaps. Landscape-scale monitoring of disturbance processes such as fire cycles, windthrow, disease, and bear-damage should be initiated. Monitoring should include periodic evaluation of the frequency, extent, timing, location, and intensity of these processes on stand types and across the landscape. Port Orford cedar root disease and Sudden Oak Death should be monitored throughout the property to determine if actions to address spread of the diseases are effective. In addition, sudden oak death assessment should be initiated if sudden oak death is detected in the vicinity of the property.

Information obtained from monitoring and detailed plant surveys will facilitate adaptive management and prioritization of potential restoration and mitigation projects. Projects could include enhancement and protection measures for rare vegetation types, such as Darlingtonia fens, knobcone pine forests, and the Jeffrey pine vegetation series.

4.2.3 Potential adverse impacts

The following potential adverse impacts may result from the recommended management actions.

- Thinning of young second-growth stands is likely to increase ground fuel loading for at least 3 to 5 years following treatment.
- Forest restoration activities may temporarily disturb certain species, potentially leading to avoidance, nest abandonment, or reduced productivity. Thinning adjacent to Class I, II, or III streams could impact water quality, cover, or food availability.
- Forest restoration activities may require temporary use of stormproofed or temporarily decommissioned roads. Heavy thinning on highly unstable slopes could result in increased erosion and sediment delivery to streams.
- Heavy thinning activities may directly or indirectly affect habitat for rare or endangered plants if they are not located and protected prior to thinning operations.

4.2.4 Potential mitigation measures

The following mitigation measures may be useful for reducing the impacts described above.

- Mitigation measures to address short-term increases in fuel loads and fire risk associated with thinning include (1) piling and burning thinned trees and slash during the winter months, (2) cutting thinned tree stems into sections and placing them on the ground to accelerate decomposition, (3) lopping and scattering or chipping smaller limbs and stems, and (4) creating shaded fuel breaks.
- Restricting thinning to certain seasons or to limited areas can reduce disturbance to wildlife. Use of hand tools near sensitive areas such as nesting sites may also be used to reduce disturbance.
- Adverse impacts to aquatic resources can be avoided by not using roads during wet weather and by avoiding excessive use of roads by heavy equipment. Heavy thinning should be avoided in highly unstable areas and minimum basal area retention standards should be determined for these areas.
- Surveys should be conducted for special-status plant species and unique vegetation types. These areas should be protected with buffers during thinning activities if thinning may negatively affect sensitive species.

DPR also has guidelines for live tree removal in young coniferous and mixed evergreen forests that may be useful in identifying additional mitigation measures (Bakken 2002).

4.3 Aquatic and Terrestrial Habitat Protection and Enhancement

Acquisition of the Mill Creek property affords substantial opportunities for protecting and restoring aquatic and terrestrial habitats because of its size, location, and existing habitat diversity. One of the primary reasons for acquiring the Mill Creek property was to protect and restore habitat for old-growth-associated species such as northern spotted owls and marbled murrelets, and to maintain and enhance high-quality spawning and rearing habitat for anadromous salmonids.


Coniferous forest stand on the Mill Creek property.

Interim management priorities include (1) protecting existing rare and endangered species, (2) protecting existing late-successional and old-growth forest stands and legacy elements, (3) restoring late-successional habitat elements to young second-growth conifer plantations, and (4) enhancing aquatic habitat by minimizing sediment delivery and other disturbance to stream channels. Recommendations for attaining many of these enhancement and restoration goals are described in Section 4.1.2 (recommendations for road management) and Section 4.2.2 (recommendations for vegetation management). To optimize habitat restoration benefits and minimize potential adverse impacts of management activities, special management areas were identified (e.g., protected areas and buffers) adjacent to (1) old-growth forest stands and residual old-growth trees, (2) known or potential northern spotted owl and marbled murrelet nesting habitat, and (3) streams that support anadromous fish or are tributary to fish-bearing streams (Figure 4-3). Special management areas were identified during the planning process that involved consultation with focused working groups, DPR, and other state and federal agencies with stewardship and regulatory oversite (refer to Section 1.2). Proposed special management areas were used to (1) analyze resource enhancement opportunities, (2) develop interim management recommendation for aquatic and terrestrial habitat protection and enhancement, and (3) prioritize other related actions described in preceding sections of this report. Activities within these special management areas should be limited to compatible recreational use with minimal impact, habitat enhancement and restoration, research, and monitoring.

4.3.1 Desired future conditions

The desired future conditions for the Mill Creek property are to protect, enhance, and restore diverse aquatic and terrestrial habitats sufficient to maintain healthy and well-distributed populations of native plants and animals, particularly those species associated with late-successional and old-growth forests.

4.3.2 Recommended actions

Establish special management areas

We recommend establishing the following special management areas on the Mill Creek property during the interim period (Figure 4-3):

- 0.25-mi buffers around all past and current northern spotted owl nest sites and activity centers identified by Stimson Lumber Company;
- 0.25-mi buffers around designated marbled murrelet suitable habitat (defined as old-growth forest stands greater than 0.3 ha in area);
- 0.25-mi buffers along the interior of the property boundary where it borders adjacent old-growth forests; and
- 300-ft buffers adjacent to Class I and Class II streams.

The following USWFS guidelines were recommended to protect and enhance marbled murrelets, northern spotted owls, and their habitat (A. Brickey, R. Hamlin, pers. comm., 2002).

- Potential nest trees and other suitable habitat components should be retained and developed during forest restoration activities.
- Stands with known past or present activity should be protected. Suitable stands should be considered occupied until appropriate surveys are conducted.
- Use of mechanized equipment should be prohibited within 0.25 mi of occupied stands during the breeding season (March 24th to September 15th). Furthermore, noise should be kept at or below background levels.
- Forest management activities, such as thinning, should not be conducted within 0.25 mi of stands occupied by marbled murrelets and northern spotted owls during the breeding season.
- Picnic areas, campgrounds, and trailheads should not occur within 0.25 mi of marbled murrelet habitat to avoid disturbance and attracting nest predators.

The following guidelines have been recommended by NMFS (2000) and FEMAT (1993) to protect and enhance riparian and aquatic habitat.

- 300-ft buffers should be established around Class I and II streams. Activities within buffers should be limited to compatible recreational use with minimal impact, habitat enhancement and restoration, research, and monitoring. Activities that can disturb vegetation or that result in sediment delivery to stream channels should be mitigated.
- Watercourse protection areas should extend at least 50 ft beyond the first slope break when inner gorge slopes are >50% (for Class I, II, and III streams).
- Disturbance from skidding and mechanical site preparation during forest restoration, road reconstruction, and road upgrading should be avoided during the winter period (October 1 through May 31) and during wet weather conditions outside of the winter period, where activities will result in sediment delivery to stream channels.

Special management areas should also be established around unique and sensitive plant communities. The size of the management area should be tailored to the habitat requirements, size, and sensitivity of the plant species or community.

Research, monitoring, and adaptive management

The Mill Creek property provides an excellent opportunity to gather baseline data then monitor the effectiveness of restoration activities over time. A comprehensive watershed monitoring strategy should be developed that identifies goals and critical assumptions, establishes parameters, guides collection and storage of data, and is used to predict and evaluate landscape response to habitat management activities. There are many uncertainties about specific distributions for many sensitive species on the property. Monitoring, research, and adaptive management are addressed by species.

Figure 4-3. Priority aquatic and terrestrial habitat management areas.

Salmonids

Monitoring of juvenile outmigration and adult escapement should be continued to (1) provide information on life-stage-specific survival rates and long-term populations trends, and (2) increase our understanding of the potential factors limiting population abundance and survival. Salmonid reproductive success depends on the availability of suitable spawning and rearing habitats. Little information is available, however, concerning the existing location, amount, and quality of these habitats on the Mill Creek property. We recommend repeatable surveys to determine the quality and quantity of habitats that may affect life-stage-specific survival. In particular, detailed surveys that establish existing locations, quality, and quantity of juvenile coho salmon and steelhead overwintering habitat would be useful for protecting critical overwintering habitat, prioritizing habitat restoration activities, and providing baseline information against which to measure changes over time. Surveys should be conducted to verify the upstream limits of anadromous fish distribution and the distribution of other aquatic species of concern.

Establishing continuous gauging of precipitation, streamflow, and sediment discharge is necessary for monitoring the effectiveness of future watershed restoration activities following public acquisition. Monitoring water and sediment discharge will provide information on the short-term impacts of restoration activities and the long-term recovery rate in the Mill Creek and Rock Creek watersheds. An understanding of the timing and magnitude of flow events is critical to proper interpretation of the factors controlling the distribution, carrying capacity, and survival of juvenile salmonids. Without gauging records, hypotheses regarding carrying capacity and fluctuating production will remain speculative and un-testable. Gauging in the Redwood Creek basin, Humboldt County, California provides an excellent model.

Numerous opportunities exist for aquatic and riparian habitat restoration on the property. Instream restoration projects could be implemented to improve fish habitat where instream complexity may be currently lacking. Continued conifer under-plantings and release in hardwood-dominated riparian areas could be used to accelerate reestablishment of riparian conifers. These conifers will ultimately provide terrestrial wildlife habitat, shade, cover, and instream large woody debris. Existing instream structures may require future monitoring and maintenance until riparian areas have recovered. The West Branch Mill Creek channel was routed around the mill site in the early 1960s. The potential benefits, feasibility, and costs of restoring the West Branch channel back to its original position should be considered.

CDFG has established catch and release regulations for streams in California. DPR should work with CDFG to monitor the effects of increased recreational angling under State Park management. The effects of public access to spawning areas should also be monitored to determine potential impacts to egg survival and habitat quality.

Northern spotted owl and marbled murrelet

Regular surveys should be initiated as soon as possible to determine the status of northern spotted owls and marbled murrelets on the property. Continuous surveys were interrupted in 2000 when logging operations ceased. Many management practices may be constrained by avoidance or take regulations for federally listed species, so it will be important to know the status and distribution of these species on the property while developing management priorities. The current status of these species will also be helpful as baseline information for evaluating whether actions to restore late-successional forests are effective. Prior to implementation of site-specific projects, all areas should be evaluated for the potential to provide habitat for threatened and endangered species, including marbled murrelet. Specific targets could be developed for spotted owls and murrelets based on analysis of adjacent old-growth stand conditions.

Pacific fisher and marten
Habitat for forest carnivores, such as Pacific fisher and marten, is expected to increase on the Mill Creek property as large areas of second-growth forests develop late-successional characteristics. Because little information is available on the distribution and status of fisher and marten in the vicinity of the property, surveys should be conducted to assess their presence.

Amphibians
The current status and trends of amphibian species and their habitats should be monitored on the property to assess the potential effects of proposed land management activities, prioritize habitat protection, and identify restoration opportunities. Species with limited dispersal capabilities, such as the southern torrent salamander (Welsh and Lind 1992) may require immediate protection because re-colonization is unlikely if source populations are extirpated.

Invertebrate communities
Research conducted in Prairie Creek Redwood State park and other areas near the Mill Creek property indicate that forest insects and related arthropods are vital ecosystem components and useful bioindicators of ecosystem function (M. Camann, pers. comm., 2002). Research should be conducted to determine how nutrient dynamics, organic litter processing, and soil and litter microarthropod assemblages respond to forest restoration on the Mill Creek property.

Unique, rare, and special status plants
Darlingtonia fens are a small, rare plant community type that is currently being encroached on by surrounding vegetation due to past land management practices. We recommend protecting and enhancing Darlingtonia fens and adjacent habitats. The local geology may be suitable for expanding Darlingtonia fens through experimental approaches. Pure knobcone pine stands are also uncommon on the property. Knobcone pine require fire to sustain healthy populations. Redwood National and State Parks are currently using prescribed fire to restore vegetation associated with serpentine soils on the Bald Hills. Prescribed fire could be used to maintain and enhance knobcone pine stands and other vegetation associated with serpentine areas on the Mill Creek property. The Mill Creek property also supports unique old-growth stands of madrone, western white pine, and Jeffrey pine. These vegetation types should be protected and restored in areas that have experienced type conversions to commercial conifer species.

4.3.3 Potential adverse impacts

Potential impacts of implementing measures to protect aquatic and terrestrial habitats include (1) constraints on the timing and extent of other recommended management activities, and (2) constraints on public access and recreational use of the property.

4.3.4 Potential mitigation measures

Despite careful planning and restrictions, some situations may arise where "take" cannot be avoided. For example, emergency road repair actions may need to be conducted during wet periods or near nesting areas, resulting in "take" of listed salmonids or birds. Management activities that may result in "take" of protected species require consultation with the agencies having jurisdiction over these species (e.g., National Marine Fisheries Service, U. S. Fish and Wildlife Service, California Department and Fish and Game).

4.4 Public Access and Use

The Mill Creek property offers many opportunities for a broad array of non-consumptive public recreational uses compatible with ecosystem protection and restoration. Recreational opportunities during the interim period include day-use activities such as hiking, biking, fishing, and horseback-riding that utilize existing buildings and the existing road network (Figure 4-4). Several regional trails on adjacent public lands could be connected to the property during the interim period using the existing road network. Many opportunities will become available for research, environmental education, and service learning programs focused on adaptive natural resource management. Constraints to public access in the interim may include infrastructure improvements, road management, containment of forest pathogens, and fish and wildlife habitat protection.

4.4.1 Desired future conditions

Future public access to the Mill Creek property should provide a broad range of recreational and educational opportunities compatible with other resource objectives. Interim opportunities may include but are not limited to hiking, biking, horseback riding, fishing, primitive camping, interpretive activities, and environmental education. The public should be encouraged to participate in habitat restoration, research, and monitoring activities on the property. Information about these opportunities should be made available through local tourism and interpretive organizations as well as State Park offices and visitor centers.

4.4.2 Recommended actions

Create long-term recreation management plan
Planning for long-term public access on the property, including vista points, picnic and camping areas, educational facilities, trails, and lodging must consider the goals of long-term road and forest management and potential impacts on sensitive species and their habitats.

Develop headquarter facilities at the Old mill site
The old mill site contains buildings and large paved areas. Paved areas could be used for parking and as staging areas for interpretive hikes and trailheads. Buildings at the mill site could be used to house DPR personnel or equipment, temporary interpretive centers, and educational facilities. Potable water and sewage systems would need to be developed at the site.

Evaluate the feasibility for establishing day-use facilities at the existing picnic area
Stimson Lumber Company established a picnic area on Picnic Road off Hamilton Road. No facilities are currently available at the site, however, the area may be suitable for day use, special events, and primitive group camping. Picnic Road, the primary access road to the picnic site, could also link Hamilton Road to the existing Mill Creek Campground. Picnic Road, however, is a valley bottom road that locally confines the West Branch Mill Creek and has a number of potential hillslope instability and road drainage problems. Public vehicular access to the picnic area should be restricted until potential road stability and erosion problems are addressed.

Vehicular Road Access
Public vehicular access should initially be limited to the paved segment of Hamilton Road connecting Highway 101 and the mill site (Figure 2-1). Additional near-term public vehicular access should be

considered between the mill site and potential public use sites located along Childs Hill Road at (1) the junction of Rock Creek Road, and (2) at the East Fork Mill Creek crossing near the center of T15N, R1E Section 3. These two sites are located at critical intersections in the primary (haul) road network not far from the mill site beyond which the roads narrow and steepen. Gates or other movable barriers should be installed to restrict public vehicular access to all other primary and secondary roads originating from Hamilton and Childs Hill roads between Highway 101 and these two public destination points.

Motorized vehicle access to the Childs Hill-Rock Creek loop road should initially be restricted to State Park personnel and other authorized vehicles until (1) funds are available to maintain the loop road in a condition that is safe for public use with minimal environmental impact, and (2) access to all roads originating from the loop road can be controlled and monitored.

Establish trails

All primary and secondary roads should be considered for pedestrian, equestrian, and bicycle use during development of a trail system for the property. Future trails within the property should connect to existing regional trail networks. Potential regional trail connections include the Rellim Trail located west of the property in Redwood National Park and the Bald Hill Trail located north of Bummer Lake Creek within Six Rivers National Forest. Decommissioned roads should be considered for use as recreational hiking, biking, and equestrian trails, as well as authorized ATV access for management activities.

Implement fire hazard measures

Fire potential is high in certain areas of the Mill Creek property. The following fire management activities are recommended and may affect public access and use on the Mill Creek property:

- seasonal road closures in high-risk areas;
- smoking and campfire restrictions during the dry, high-risk season;
- maintenance of defensible space around all buildings and public use areas; and
- temporary closures due to fire management practices.

Educational and service-learning opportunities

The Mill Creek property provides many opportunities for DPR and school districts within Del Norte County and elsewhere to develop restoration, research, and monitoring projects for students to learn about scientific research and environmental management. These programs could be designed to provide the State Park with data useful for making resource management decisions. Appropriate oversight and review of student monitoring activities would be necessary to ensure that research is designed to achieve the desired objectives and data are properly collected and interpreted.

Research, monitoring, and adaptive management

A visitor carrying capacity analysis should be conducted to determine appropriate levels of visitor access and use that minimize adverse impacts on resources and the visitor experience. Carrying capacities should be established for various sites on the property based on monitoring (1) the type and extent of visitor use, (2) impacts to natural resources, and (3) visitor experience. The carrying capacity study can be used with other environmental monitoring to identify appropriate levels and timing of public use, mitigation and restoration actions, and other management recommendations. Other specific monitoring recommendations include long-term vegetation monitoring to determine the effects of foot traffic in frequently used areas and in sensitive areas such as riparian corridors and important fish habitat. Monitoring should begin as soon as DPR identifies public use areas so that baseline conditions can be established prior to public use.

4.4.3 Potential adverse impacts

Improving public access to the property may adversely impact natural resources and increase activities such as illegal camping, off-road vehicle use, poaching, firewood gathering, and collecting of native plants and animals. Impacts associated with public use may extend to listed species and may increase costs associated with maintaining the property and protecting resource values.

Riparian and upland vegetation
Recreational use can impact riparian as well as upslope vegetation and soils. Hiking, horseback riding, and mountain biking use may accelerate erosion by compacting soils and concentrating run-off. The magnitude of such impacts depends on number of visitors, soil types, vegetation, topography, and proximity to riparian areas. Within riparian areas, the greatest impacts are likely to occur within 5 m (16 ft) of the stream channel (Clark and Gibbons 1991). Loss of vegetation and soil compaction in riparian areas can reduce habitat quality for salmonids by reducing cover, food, channel shading, and bank stability, and by increasing sediment delivery to streams. Human use of riparian areas may also reduce the quality of these important habitats for nesting birds and other species.

Fisheries and aquatic habitat
Increased recreational fishing on the Mill Creek property could result in impacts to salmonids. Cutthroat trout may be vulnerable to recreational fishing pressure because they inhabit freshwater environments longer than other Pacific salmonids (Johnson et al. 1999). Angler harvests have contributed to substantial declines in population abundance throughout the range of coastal cutthroat trout and other subspecies of cutthroat trout (Johnson et al. 1999, Young 1995). Declines in mean length or size of adult fish have been reported for cutthroat trout subjected to fishing pressure (Johnson et al. 1999, Young 1995).

Water-based recreation such swimming, bathing, boating, and using off-road vehicles in stream channels can affect aquatic habitats by increasing nutrient and fine sediment supply, trampling banks and riparian vegetation, and decreasing large woody debris, which is often removed by swimmers, boaters, and anglers (Clark and Gibbons 1991).

Forest pathogens
Public use can spread noxious weeds and forest pathogens. Public access into areas affected by POC root disease or SOD may increase the potential for spreading disease to other areas. Vehicles, shoes, and horses can transport *Phytophthora* spores. Impacts may be greater during the wet season when runoff can disperse spores to the host trees. Section 4.2.2 describes recommendations for limiting disease dispersal.

4.4.4 Potential mitigation measures

Public access and use should be restricted in special management areas during certain times to reduce impacts on sensitive species and their habitats. Section 4.3.2 lists areas where public access should be seasonally restricted. Public access to areas affected by POC root disease and SOD should be restricted.

Charging fees, limiting the availability of parking or size of campgrounds, or requiring reservations are methods that could be used to control the amount or intensity of public use on the Mill Creek property. Impacts on unstable roads, riparian areas, and other sensitive habitats may be reduced by restricting access to paths, providing guided walks, providing alternative public transportation, or limiting the size of vehicles allowed on the property.

Figure 4-4. Priority public use areas.

Chapter 5

Glossary

5 GLOSSARY

Abandoned Road — A road that is no longer maintained. An abandoned road may or may not still be drivable and may or may not be overgrown with vegetation.

Activity Center — An area or territory used by an owl for foraging, roosting, and breeding.

Alevin — Recently hatched salmon that still have an attached yolk sac.

Alluvial — Referring to deposits resulting from natural river activity, including sediments laid down in river beds, flood plains, lakes, fans at the foot of mountain slopes and estuaries.

Anadromous — A life history strategy in which fish are born and reared in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce.

Basal area — The cross-sectional area of trees per unit area measured at breast height or 4.5 ft above the ground.

Benthic — Of, relating to, or occurring at the bottom of a body of water.

Bole — The lowermost part of the trunk of a tree.

Buffer — A forested area located adjacent to a sensitive resource that reduces the effects of adjacent management actions on the resource.

Calwater — Calwater is a set of standardized watershed boundaries for California nested into larger previously standardized watersheds and meeting standardized delineation criteria.

Candidate species (Federal and State) — A candidate for listing under the Endangered Species Act (ESA). More specifically, it is a species or vertebrate population for which reliable information is available that a listing under the ESA may be warranted. There are no mandatory federal (or state) protections required under the ESA for a candidate species.

Canopy closure — The degree to which the canopy blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy that account for the openings in the branches and crowns.

Canopy cover — A measure of the percent of potential open space occupied by the collective tree crowns in a stand.

Channel migration zone — The boundary generally corresponds to the modern floodplain, but may also include river terraces that are subject to significant bank erosion. The area adjacent to watercourses constructed by the river in the present climate and inundated during periods of high flow.

Class I watercourse — Watercourses in which fish are always or seasonally present onsite or within 100 ft downstream of an operation area. This designation includes domestic water supplies such as springs and habitat to sustain fish migration and spawning. (CFPR)

Class II watercourse	Watercourses in which fish are always or seasonally present offsite within 1,000 ft downstream and/or provides aquatic habitat for nonfish aquatic species. This designation excludes Class III that are tributaries to Class I waters. (CFPR)
Class III watercourse	Watercourse in which no aquatic life is present. The watercourse shows evidence of being capable of sediment transport to Class I and II waters under normal high water flow conditions after completion of timber operations. (CFPR)
Clearcut	A harvest method where an entire stand of trees is removed in one cutting operation, leading to the establishment of an even-aged stand.
Coarse sediment	Fine gravel and larger sized particles deposited by water or ice.
Corvid	A bird of the family Corvidae, which includes jays, ravens, and crows.
Critical habitat	Under the federal Endangered Species Act, critical habitat is defined as: (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.
Culvert	Buried pipe structure that allows streamflow or road drainage to pass under a road.
Cumulative watershed effect	Those effects that occur within and near bodies of water or significant wet areas, where individual impacts are combined to produce an effect that is greater than any of the individual impacts acting alone. Factors considered are: sediment, water temperature, organic debris, and chemical contamination. (CFPR)
Debris slide	A relatively fast moving (inches per day to feet per minute) landslide of relatively thin soil where the original soil structure is severely disrupted. Most of the disturbed soil moves off the site of the rupture.
Decommissioned road	A forest road that is no longer in use and has been treated so that exposed soils and unstable fills are stabilized; fill and drainage structures at stream crossing sites are entirely excavated, with excavated material stored where it will not enter stream channels, the road surface is graded or contoured such that surface drainage is dispersed onto stable sideslopes; and the road is blocked so that standard production four-wheel drive vehicles cannot pass the point of closure.
Detritus	Loose material, such as organic particles or rock, resulting directly from disintegration or wearing process.
Diameter at breast height (dbh)	The average diameter of a tree measured outside the bark at breast height - a point 4.5 feet above average ground level.
Digital terrain model	A grid-based dataset of elevation values for a land area used to

(DTM)	develop terrain characteristics, such as drainage area, aspect, and slope.
Digital orthophoto quads (DOQ)	A computer-generated image of an aerial photo from which displacements caused by camera orientation and terrain has been removed.
Dissolved Oxygen (DO)	Oxygen found in solution with water in streams and lakes. Solubility is generally measured in mg/L and varies with temperature, salinity, and atmospheric pressure.
Dominant tree	Trees with well-developed crowns extending above the general level of the forest canopy and receiving full light from above and partly from the sides.
Drainage	An area (basin) mostly bounded by ridges or other similar topographic features, encompassing part, most or all of a watershed.
Early-successional	Stage in forest development that includes seedling, sapling, and pole-sized trees.
Edge	An area where different ecological communities meet or where different successional stages or vegetative conditions within communities come together.
Embeddedness	The extend to which large particles (boulders, rubble, gravel) are surrounded or buried by fine sediment, usually measured in classes according to percent coverage
Emergence	The time at which egg-sac fry (alevins) leave the interstitial spaces within the redd and enter the water column.
Endangered	Any plant or animal species in danger of extinction in all or a significant part of its range
Escapement	Anadromous fish that escape commercial or recreational fishing and return to their natal streams to spawn.
Even-aged management	The application of a combination of actions that results in the creation of stands, in which trees of essentially the same age grow together. Clearcut, shelterwood or seed tree cutting methods produce even-aged stands.
Evolutionarily Significant Unit (ESU)	This unit is a population which is reproductively isolated from other populations of the same species, being significant in terms of evolutionary history and adaptive potential of the species. The populations listed were sufficiently distinct that their extinction would have compromised the viability and evolutionary potential of the entire species.
Fine sediment	Sediment with particle sizes of 2 mm and less, including salt, silt, and clay.
Fingerling	Generally referring to the juvenile life stage of a salmonid fish species between the fry and parr stages.
Floodplain	The lowland and relatively flat areas adjoining streams.
Forest fragmentation	Isolating or breaking up large tracts of forest as a result of natural events (such as wildfire) or by the implementation of timber

	management or other human activities.
Fry	Life stage of trout and salmon between full absorption of the yolk sac and a somewhat arbitrarily defined fingerling or parr stage (generally reached by the end of the first summer).
Geographic Information System (GIS)	A computer system capable of storing and manipulating spatial data. A geographic information system has four major components: a data input subsystem, a data storage and retrieval subsystem, a data manipulation and analysis subsystem, and a data reporting subsystem.
Habitat	The sum of environmental conditions at the landscape, patch, and element scales, necessary to meet the life requirements of individuals of a species.
Haul roads	Permanent all-season transportation roads with surfacing suitable for hauling of forest products throughout the entire winter period and have drainage structures at watercourse crossings that accommodate the 50-year flood flow and are normally maintained in the winter (CFPR).
Humboldt crossing	A drainage structure made out of logs laid in parallel to a stream channel and then covered with soil. Prior to the mid - 1980's, Humboldt crossings were often used as permanent crossings instead of culverts or bridges, however, they are highly susceptible to plugging and wash outs. Currently, they are only used as temporary crossings, which are removed prior to the winter period.
Incidental Take Permit (ITP)	A permit issued by the USFWS or NMFS or a non-federal entity that allows the incidental take of a threatened or endangered species; requires the permittee to carry out specified actions that minimize and mitigate the impacts of the incidental take to the maximum extent practicable, and in a manner that does not appreciably reduce the likelihood of survival or recovery of the species in the wild.
Insloped road	A road where the surface is sloped in toward the cutbank. Insloped roads usually have an inboard ditch that collects runoff from the road surface and the cutbank.
Interior forest	The portion of the mature and old-growth forest that is buffered and protected from edge effect.
Large woody debris (LWD)	Any piece(s) of large woody debris (e.g., dead boles, limbs, and large root mass) on the ground in forest stands or in streams.
Late-successional	A maturing forest stand of dominant and predominant trees that is beginning to achieve old-growth characteristics. Functional characteristics of late-successional forests include large decadent trees, snags, and large down logs.
Lentic	A type of freshwater habitat characterized by calm water.
Life-history requirements	Physical and biological requirements of a species necessary to carry out essential behaviors from birth to death.
Littoral	The zone of a lake containing rooted plants.
Main line or primary roads	These roads are paved or surfaced with crushed angular rock. The paved sections are on Hamilton Road and near the vicinity of the

	mill site. Rocked mainline roads include Childs Hill Road, Rock Creek Road, West Branch Road, Hamilton Road and Bummer Lake Road.
Mass wasting	All geological processes in which large masses of earth materials, such as rock and soil, move downslope by gravitational forces.
Mature forest	The period of life in a forest stand from culmination of mean annual increment to an old-growth stage or to 200 years. This is the time of gradually increasing stand diversity. Hiding cover, thermal cover, and some forage may be present.
Mesic	Pertaining to or adapted to an area that has a balanced supply of water; neither wet nor dry.
Microclimate	Climatic conditions that influence organisms within a small or restricted area.
Mid-successional	The period of life of a forest stand from crown closure to first merchantability. Brush, grass or herbs rapidly decrease in the stand due to stand density.
Multi-layered	Term applied to forest stands that contain trees of various heights and diameter classes and, therefore, support foliage at various heights in the vertical profile of the stands.
Old-growth	A forest stand over 200 years old with moderate to high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; a high incidence of large trees with broken top, and other indications of decadence; numerous large snags; and heavy accumulations of logs and other woody debris on the ground.
Outmigration	The seaward migration of salmonid juveniles from their rearing areas, following or during the parr-smolt transformation.
Outsloped road	Describing a road where the inner edges of the road surface are higher that the outer edges. Thus, runoff is directed onto the sideslope downhill of the road. Outsloping is the act of converting an insloped road to an outsloped road, or creating a outsloped road surface by excavating fill from the outside of the road and placing and grading it against the cutbank.
Overstory	That portion of trees, in a forest of more than one story, forming the upper canopy layer.
Parr	The life stage of salmonid fish species where juvenile fish reside in rearing streams before undergoing the parr-smolt transformation.
Pole tree	A young tree, from the time its lower branches begin to die until the time the rate of crown growth begins to slow and crown expansion is noticeable.
Pool	Portion of a stream with reduced current velocity, often with deeper water than surrounding areas and with a smooth surface.
Port Orford cedar root disease	An introduced pathogen (*Phytophthora lateralis*) (PL) that has spread throughout much of the natural range of the POC by traveling through water and moist soil. After infection, the host tree invariably dies. High risk areas for infection are stream courses, drainages, low lying areas downslope from infection centers, and

	below roads and trails where PL is introduced.
Pre-commercial thinning	The practice of removing some of the trees less than merchantable size from a stand so that remaining trees will grow faster.
Primary road	See Main line road.
Recovery	The process of bringing something back to normal or healthy conditions.
Redd	Nest and associated mounds made in gravel, consisting of a depression hydraulically dug by a fish for egg deposition.
Residual tree	The remaining trees that are left standing after timber management such as selection cutting.
Riffle	A channel feature characterized by swiftly flowing, turbulent water and exposed substrate, usually cobble and boulder dominated.
Riparian	Areas along lakes, rivers, streams, springs, and seeps where the vegetation and microclimate are influenced by year-round or seasonal water and associated high water tables.
Riparian zone	Those terrestrial areas where the vegetation and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated with high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.
Rookery	A nesting or roosting colony of gregarious birds.
Roosting	Birds sleeping or resting. Roosting places can be occupied by a single bird or up to several million birds, depending on species. Depending on the needs of the species, roosting sites can be on the ground, on the water, in low vegetation, in trees, or on buildings. Timing of roosting often depends on the species activity pattern such as diurnal or nocturnal foraging.
Sapling	A tree, usually young, that is larger than a seedling but smaller than a pole. Size varies by region.
Secondary road	See Spur roads.
Second-growth	Timber stands established after natural or human-caused removal of the original stand or previous forest growth.
Sedimentation	The deposition of material along a stream channel.
Seep	A small spring, pool or other place where water oozes from the ground.
Sensitive species	Those species that (1) are proposed for classification and are under consideration for official listing as endangered or threatened species, (2) are on an official state list, or (3) are recognized by the USFWS, NMFS or other management agency as needing special management to prevent their being placed on federal or state lists.
SHALSTAB	A single mechanistic model for eliminating the relative potential for shallow landslides.

Sideslope	The valley wall oriented roughly perpendicular to the stream channel.
Silviculture	The science and practice of controlling the establishment, composition, and growth of forest stands.
Single-storied stand	A stand characterized by a single canopy layer of one age class of trees.
Smolt	A juvenile salmonid that has undergone physiological changes to cope with a marine environment; the seaward migrant stage of an anadromous salmonid.
Smoltification	The process whereby a juvenile salmonid's physiology changes to cope with a marine environment.
Snag	Any standing dead or mostly dead tree. A hard snag is composed primarily of sound wood, generally merchantable. A soft snag is composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable.
Species of concern	Species that are federally or state listed, or are of special interest. California Department of Fish and Game classifies species as 'species of concern" as follows: "Species of Special Concern" (SSC) status applies to animals not listed under the federal Endangered Species Act or the California Endangered Species Act, but which nonetheless 1) are declining at a rate that could result in listing, or 2) historically occurred in low numbers and known threats to their persistence currently exist."
Spur roads or secondary roads	Spur roads access timber harvest areas from main line roads and can be surfaced (with crushed rock) or unsurfaced.
State Parks	The California State Parks adjacent to the Mill Creek property, including Jedediah Smith Redwoods State Park, Del Norte Coast Redwoods State Park.
Stimson	Stimson Lumber Company, previous owner of the Mill Creek property.
Sudden oak death	Sudden oak death (*Phytophthora ramorum*) is in the same genus as the pathogen, *P. infestans*, the cause of potato late blight. Approximately 60 species of *Phytophthora* have been described worldwide. Tanoak, *Lithocarpus densiflorus*, is the most susceptible and severely affected oak in California. All size classes can be infected and killed. *Quercus agrifolia*, California live oak, and *Q. kelloggii*, California black oak, as well as a variety of other trees and shrubs can be infected by this pathogen
Surfaced roads	Roads that are surfaced with pavement or gravel.
Suspended sediment	Sediment suspended in a fluid by the upward components of turbulent currents or by colloidal suspension.
Take	Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect an animal, or to attempt to engage in any such conduct.

Understory	Vegetation (trees and shrubs) growing under the canopy formed by larger trees.
Uneven-aged	A forest stand comprised of trees in a range of age classes.
Unsurfaced roads	Roads built for temporary use during dry conditions without surfacing such as rock.
Watercourse and Lake Protection Zone (WLPZ)	A strip of land on both sides of a watercourse or around a lake or spring, where additional management practices may be required for erosion control and for protection of the quality and beneficial uses of water, fish, and riparian wildlife habitat.
Vegetation series	A series is a floristically defined vegetation type identified by its dominant and/or characteristic species. Series are easily defined by using basic rules of dominance - the type being named by the single or shared dominant species in the highest strata in a given stand of vegetation.
Watershed	The total land area draining to any point in a stream, as measured on a map, aerial photo, or other horizontal, two-dimensional projection.
Young-of-the-year	A life stage of salmonid fish species, referring to juvenile fish that are residing in rearing streams during the year of their emergence.

Chapter 6

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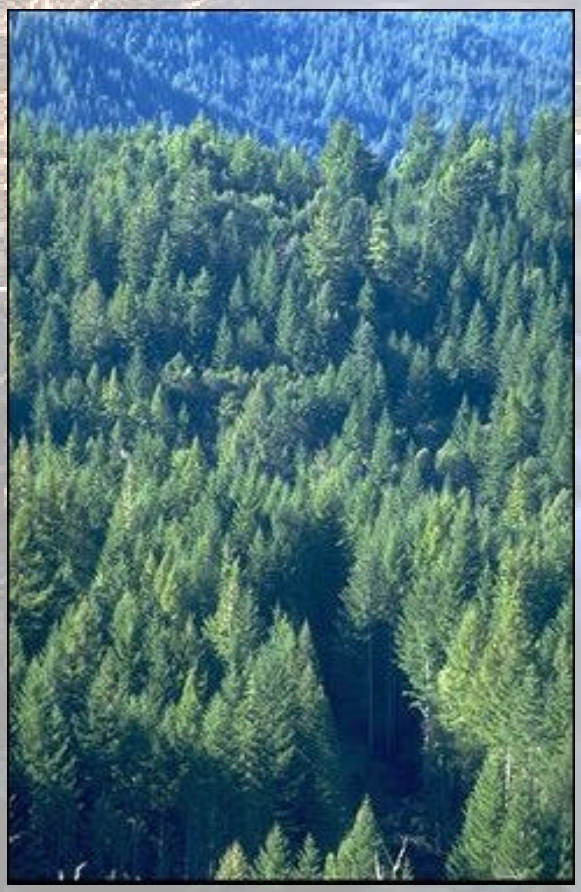

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Appendices

APPENDIX A - Issues raised during initial scoping meetings

Access and use

- Where and what type of public access opportunities will be provided?
- How will visitor health and safety be ensured?
- What actions are necessary to ensure public access does not conflict with other resource management goals (e.g., habitat protection and enhancement)?
- What opportunities are available for environmental education?

Roads and infrastructure

- What are the potential impacts of maintaining existing roads in different areas of the property?
- What are the potential cumulative impacts of existing road densities at the basin scale?
- What criteria should be used to assess potential erosion risk, and what are the risk thresholds that necessitate road upgrade or removal?
- How and where will existing roads be maintained, upgraded, and/or removed to ensure adequate protection of aquatic and terrestrial resources?
- What are the critical elements to include in a road assessment and maintenance program?
- What opportunities exist for adapting existing structures for new uses (e.g., public interpretation and education)?
- How will a reliable water supply be developed for the property?

Aquatic and terrestrial habitat

- What measures will be taken to promote recovery of listed and special-status species?
- How will riparian zones be managed to protect and enhance the aquatic ecosystem?
- Is aquatic habitat quality or quantity limiting anadromous fish production, and if so, what habitats are potentially limiting and why?
- Is habitat restoration necessary for increasing the abundance or distribution of fish populations during the interim period?

Vegetation management

- How will sensitive plant populations be identified and managed?
- Should the property be actively managed to promote restoration of late-successional forest characteristics?
- Can silvicultural treatments be used to accelerate development of late-successional characteristics in young conifer plantations?
- How will plant pathogens such as *Phytophthora lateralis,* be identified and contained? How will invasive introduced plants be controlled?

Fire

- What measures will be taken to protect the property from catastrophic wildfire?
- Where are the existing and potential future source areas for natural and introduced fire ignition?
- Can silvicultural treatments be used to reduce catastrophic wildfire risk?
- Should natural or induced controlled burning be used as an ecosystem management tool?

Research, monitoring, and adaptive management

- What are the objectives and scope of future fisheries research and monitoring on the property?
- How can opportunities be created for collaborative research with academic institutions?
- Can Mill Creek serve as a reference basin for trend monitoring?
- What adaptive management protocols and metrics should be established to ensure that management and use of the property are consistent with ecological goals

APPENDIX B - Meetings notes and participants in the planning process

PUBLIC MEETINGS

Initial public meeting

Stillwater Sciences

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MEMO

Date: March 07 2002

To: Ruskin Hartley
Company: Save-the-Redwoods League

FROM: Stillwater Sciences

SUBJECT: Notes from Mill Creek Public Meeting in Crescent City on February 21, 2002

Message:

Linda Edgar - President of the NW Trail Riders
Linda was concerned about continuing horse access, especially in the Miller-Rellim (MR) area (Knee Knocker Trail). She pointed out that MR, Stimson, and RNSP granted equestrian access and that Rellim Ridge and Mill Creek Trail make a loop. She offered that the NW Trail Riders will help maintain trails. She suggested connecting the coast-to-crest trail via Old Kelsey Trail. The trail connects Crescent City to O'Brian and has a lot of historic structures located along it. She was also interested in horse camps along the creek (see Cuneo Creek horse campsite as an example) and is concerned about parking for horse trailers. She pointed out that a the plan needs to include a balance between public access, restoration, and land management.

David Olhowshi
David was concerned about bicycle access and trails. He mentioned the shortage of free or low cost camping along the coast for low and middle income families. He would like to see access to the upper West Branch of Mill Creek and forest management projects that provide firewood for the community. He emphasized the need for space to dispose of community sewage sludge.

Martin Kelley
Martin emphasized the need to separate transportation routes for different users (hikers, bikers, equestrians, and vehicles). He also noted the importance of keeping potential Highway 101 routes in mind when siting facilities and uses in the park. He considers having only two access points to the property

(Hamilton Road and Little Bald Hills road) a problem. The road out of Rock

Creek is in very poor shape and there are no roads to Rattlesnake Ridge (except jeep trails). He feels the IMR need to identify a loop road connecting these access points. He suggested 1) linking Jed Smith and Mill Creek campgrounds together; 2) connecting to the coast-to-crest trail via Kelsey trail from Crescent City to Happy Camp to Ft. Jones and the Scott River Valley; and 3) linking trails to the coast-to-cave trail. Trails could use existing mining camps and the old railroad track with the existing trestles. His priorities are 1) habitat protection, 2) trails, and 3) structures and facilities.

Eilene Cooper, Friends of Del Norte
It's important that RNSP oversee management of the parcel. The IMR should identify and prioritize stream restoration and sedimentation problems. She suggested:
decommissioning unnecessary logging roads
re-establishing old-growth characteristics
Ensuring habitat connectivity to adjoining park areas
developing trails that connect with existing park trails
continuing ongoing salmon studies
providing educational opportunities
training and employ local people
addressing invasive plants and pathogens.

Emily Dehuff
She is new to the area but thinks it is important to be involved

John Murrs
John wants the positive economic impacts of this acquisition (such as creation of park jobs, enhanced tourism, increasing sales tax revenue, etc.)to be monitored.

Ernie Perry - Community Development Director for Del Norte County
Ernie restated the County's concerns about potentially significant economic impacts. He pointed out that the IMR need to consider alternative routes for Highway 101. He also pointed out that the power line route to Klamath was already relocated at great cost. Trails in the Mill Creek area should connect to the Hobbs-Wald trail from Crescent City to Howland Hill, which will be a multi-use trail surfaced with crushed rock and pavement. The existing railroad grade provides a suitable alignment. In addition, the Old Highway 199 could be a potential trail route.

Zach Larson
Zach suggested that the Park should be patient with providing public access until it can be properly controlled and enforced.

Kathy Walker - NW Trail Riders
Kathy pointed out that multi-use trails (used by equestrians, hikers, bikers, dogs, etc.) seem to work without problems.

Working Group meetings

Advisory Group Meeting

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MEMO

DATE: February 28, 2002

TO: Meeting participants

FROM: Stillwater Sciences

SUBJECT: Notes from Mill Creek Advisory Group meeting in Crescent City on February 21, 2002

Priority Issues

- Continue fish monitoring at Mill Creek.
- Identify high priority areas for road maintenance, repair, and where appropriate decommissioning.
- Provide public recreational opportunities consistent with long-term objectives
- Create education opportunities consistent with long-term objectives.

Plan Development and Permitting

- Park planning efforts generally have a statement of purpose - a statutory or other statement of values and purposes that guides scoping and helps establish constraints/primary objectives. This statement helps the public organize their thoughts and comments. The SRL statement of objectives for the acquisition may fulfill this statement of purpose for Mill Creek.
- The Interim Management Recommendations (IMR) scope should be responsive to public concerns. The public meetings set in the IMR scope of work are not to satisfy a regulatory/statutory requirement. They are intended for public outreach, initial scoping, and to develop a public record.
- Identify items that have to be implemented immediately upon acquisition (e.g., fish monitoring, road maintenance). Develop criteria and actions for 1 to 3 year time frame. The timeframe could be longer (3-10 years or more) if funds for longer term planning efforts are not secured. May need to consider longer-term issues such as road decommissioning and restoration forestry. Priorities must be set for

the interim and long term. Actions and recommendations should be balanced for each issue.

- IMR should identify programs, but be careful to clarify programs vs. mitigation (i.e. fish passage vs. stream restoration, restoration forestry etc. may need to be viewed as programs not mitigations).
- IMR should be suitable for adoption with negative declaration during CEQA planning process. Endangered species consultation issues should be considered in the time frame.
- Once the state takes control of property there are several options for long-term planning: (1) an addendum to the RNSP General Management Plan / General Plan (GMP / GP) or (2) stand-alone GP. The preference is to make the IMR an addendum to the GP.
- The agencies will need to assist in determining the number of hard copies of the IMR and their distribution. **ACTION**

Data Acquisition and Management

- Confidentiality is a concern. Proprietary data/information used in planning process should not be accessible to public.
- GIS information needs to be provided to Del Norte County and Dave Best at RNSP. Heidi Constable at the County and Ken Wright at Six Rivers National Forest should be involved for compatibility.

Forest Management/Pathogens

- The IMR need to identify stands that may need active management for fire risks and promoting late successional characteristics.
- There is a concern about the level of detail in the IMR, e.g., can we identify stands for restoration but not the level or type of actual restoration. Use park protocol for identification of stands for restoration forestry. The park was in the process of developing guidelines. These guidelines will include long-term prescriptions and site-specific recommendations. The process was put on hold due to the EIS. There is a problem with public perception of the State cutting trees in parks.
- Industry generally treats 1-5 yr. stands with herbicide applications or mechanical methods to improve early conditions for planted seedlings. There is a tradeoff between economic vs. environmental values. The IMR may need to address this tradeoff, it may be easier to do in the IMR than in the GP. Bear damage to stands is a concern where redwood is damaged and stands convert to Doug Fir.
- USFS Region 5/6 has Port Orford cedar management strategy to prevent spread of root rot. Laura Chapman considers the S. Fork Smith River affected including some POC up Rock Creek. Obtain the management strategy (draft plan?) from Laura Chapman. **ACTION**
- Obtain RNSP second-growth management plan (from Ruskin) **ACTION**

Adaptive Management

- Concept for adaptive management: try different types of management and see how it works. The parks support using adaptive management on the property. Andy Ringold can provide information. **ACTION**
- Identify the best way to meet adaptive management strategies/objectives - use opportunities to gather information on ecological functions in a transition landscape.
- Ongoing research and adaptive management: there may be short-term detrimental effect on the resources being managed with longer-term benefits.

Road Network

- The park must assume maintenance associated with roads, ditches, culverts, etc. as soon as acquisition is complete. The IMR need to identify these maintenance and operational requirements - current needs vs. longer-term concerns. RNSP cannot maintain all roads. The IMR in the short term are likely to shut down access. Maintenance will need to be stratified for open vs. temporarily closed roads and for recently decommissioned roads. Roads can be selected for decommissioning without a GP if they are a hazard for resources of concern. Thus the IMR can identify problematic roads for near-term decommissioning. Long-term decisions related to decommissioning will be part of the long-term GP.
- Identify high priority restoration and maintenance needs for outside funding. Rick Sermon is looking at funding for road maintenance as a separate task item. There may be opportunities through CDFG's adaptive watershed program (10 working days for funding turnaround).
- It was suggested that PWA, Stimson, and Mitch Farro meet to discuss roads data/needs. They can provide good recommendations for road priorities based on original surveys and knowledge of the landscape. **ACTION**
- Fire access is an important issue. It will be necessary to have CDF respond to road access issues for fire prevention.

Public Access (Recreation, Education, and Research) and Facilities

- The IMR should identify existing facilities but the Park will need to evaluate them (e.g., office building/shop).
- Permanent facilities will be addressed in GP but the IMR should address initial interim facilities designed to accommodate public day use (e.g., old office for orientation, water, and restrooms). Initial public facilities will be low impact. Examples of interim facilities: picnic areas with restrooms but not water (use old picnic area along the West Branch?), existing indoor multipurpose room (e.g., for docent presentations). It was suggested that the IMR identify good swimming holes for access by public large groups.
- The IMR should set the framework for outdoor education /environmental education and service learning facilities. Educational

projects should be designed to enhance property (e.g., fish monitoring or other monitoring that can be executed by students). Education department requests some office space to interface with RNSP and schools. Natalie Schafer could be located on site to provide that service. Need more information on relationship between Parks and schools. **ACTION**

- The IMR should consider vehicular routes to key destinations for public. Identify road and circulation issues associated with these routes. Identify where and how to restrict vehicle access (e.g., gates, boulders, etc.)
- The IMR should identify ways to minimize potential conflicts among pedestrians, cyclist, and equestrians.
- The IMR should consider hiking trails that don't require access through the main entrance (e.g., trailheads off Howland Hill Rd to upper Mill Creek campsite, parking lot at old demonstration forest at head of Hamilton road). Consider connecting to existing regional trails (e.g., PCT connection to coast trail)
- Control of access issues: closing areas at night, overnight facilities, primitive environmental camps.
- RSPs has asked for 13 positions including ranger, field staff, and scientists for the acquisition.
- Activities initiated in the IMR will set the stage for the future, thus it is key to start conservatively.
- Consider emergency access for people from Big Flat
- Remediation of hazardous areas near the mill site is ongoing. It is assumed that hazardous materials issues will be taken care of prior to the change in ownership.

Wildlife and Fisheries Impacts/Monitoring

- Mill Creek could serve as a reference stream/watershed. The IMR should address baseline monitoring protocols. HSU, UCB, Sonoma State are interested in large research scale projects.
- The IMR should address potential fisheries impacts associated with increased public access. Evaluate how and to what extent sportfishing can be consistent with fish and wildlife preservation and restoration. Cutthroat and steelhead catch and release fishing pressure on property is currently low but if public fishing increases, are regulations adequate to protect the fish resources? A monitoring program is important to evaluate suitability of existing regulations. A game warden at the gate (single access?) can provide enforcement.
- Ongoing fisheries monitoring should be incorporated into educational programs. Connect fisheries monitoring with school/education to provide opportunities for students that can benefit the resources. Need to identify appropriate monitoring strategies that can be conducted by students. The public needs to understand the importance of fish monitoring - there is a need to explain why it is important for an effective IMR/GP.
- Marbled murrelet were detected in Paragon last year but no detections

this year - USFWS would like to know if this is a fluke. USFWS wants to know if there is long-term use of the stands. Northern spotted owl sites and movement will be important for facility construction/siting. Darlingtonia sites were surveyed by SHN.

- Rock Creek has not been extensively monitored/evaluated. CDFG would like to set up monitoring protocols.

Funding

- Coastal Conservancy planning grant awarded to develop IMR.
- RSP prepared a Proposition 13 proposal for roads - a 2-page pre-proposal was submitted.
- There are funds available for water quality and aquatic macroinvertebrate projects.
- Foundation grants may be another source of funds.
- Educational opportunities will bring in more dollars.
- A permanent commitment of resources cannot be considered for the IMR, but it should lay the framework.
- There is a concern about sustainability - the question about setting up activities funded from soft money with an expectation for sustainability when it depends on operating funds from DPR or wherever.
- Funding will be limited so the IMR should identify priorities.
- Consider land swapping in Terwar and Wilson Creeks in exchange for parcels within the Mill and Rock Creek basins.

Vegetation Management

Stillwater Sciences

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MEMO

DATE April 22, 2002

TO: Meeting participants

FROM: Stillwater Sciences

SUBJECT: **Mill Creek Vegetation Management Working Group**
Notes from the meeting at the federal building in Arcata
April 8, 2002

Note:
The following notes are organized by general subject area and are not necessarily in chronological order. The notes represent statements made by one or more individuals in the group and do not necessarily represent the views of the group as a whole.

1. Introduction and initial questions
The meeting was opened with an initial statement of objectives relating to future vegetation management on the Mill Creek property, with a focus on second-growth forest management during the period encompassed by the Mill Creek property Interim Management Recommendations (IMR)(refer to the attached Vegetation Management Working Group handout).

Suggested modifications to the existing objectives included the following:
- Expand the restoration objective to include more diverse vegetation and habitat conditions than "late successional forest characteristics".
- Define what is meant by "associated natural functions" at stand, forest, basin, and regional scales.
- Expand "research opportunities" to include more than just "fish and wildlife".

The following question was brought forth during the introductory discussion: "how much flexibility do we have under existing state and federal regulations to actively manage second-growth forests"?
- deeding the entire acquisition area to DPR may limit ability to apply second-growth vegetation management practices. Limitations may stem from potential conflicts between State Park mandates and the cutting, removal, and commercial utilization of forest resources derived from restoration forestry

practices.

- Alternative approach could dedicate a portion of the property to DPR (e.g., the confluence area and low gradient tributary valleys) while the remaining area would be managed by another undefined entity (e.g., private institute, SRL, or state experimental forest) capable of implementing a broad array of second-growth management strategies.

The IMR should create a collaborative, decision-making framework for conversion of the property from an industrially managed forest to a public resource.

2. Desired future forest conditions on the Mill Creek property
Late successional forests are characteristically dynamic and are comprised of a shifting mosaic of early-,mid- and late-successional vegetation communities.

Describe desired future conditions (DFC) in terms of structure, composition, and process. Measurable attributes of the DFC could include:

- spatial and temporal complexity at the landscape scale, including connectivity and continuity between the Mill Creek area and adjacent areas;
- complexity in forest structure and complexity at the basin and subbasin scales; and
- complexity at the site or stand scale.

Forest conditions prior to large-scale industrial timber harvest (1950's) could be used to define and stratify the DFC. The California soil-vegetation mapping conducted in the 1950's and 1960's could be used as a first cut to define the distribution of forest types. These units may be useful for defining forest type but not structure (i.e. stems/ac or distribution of stems). Soil-vegetation mapping in Mill Creek could be compared with the soil/vegetation mapping in Jed Smith State Park where vegetation patterns may retain their pre-European characteristics. The soil-vegetation maps, however, are based on soil and vegetation patterns interpreted from aerial photographs which, in many cases, were not ground-truthed. In addition, the mapping is a snapshot in time and may reflect intervention prior to the 1950's.

In addition to a definition of the DFC, interim and long-term management planning will require a framework for the inventory and monitoring of existing and future conditions. The following example was offered.

- Blodgett Forest is divided into three approximately equal areas with (1) no active management, (2) management strategy A, and (3) management strategy B. Systematic monitoring in each of the three areas is used to determine the effectiveness of alternative management practices and their impact to resources of concern.

Recommendations for stratifying and monitoring vegetation:

- species composition, structure, and density
- age class
- previous silvicultural treatments
- physiography (elevation, slope steepness, and aspect, soil map unit, geologic map unit)

- site potential
- proximity to roads
- proximity to watercourses
- proximity to threatened, endangered, and sensitive species and their habitat. Refer to the habitat models for key species in Stimson's Draft Multi-species Habitat Conservation Plan (HCP). It may be best to consider suites of key species - refer to the Stimson Draft HCP, the Smith River Ecosystem analysis, and past RNSP work. Participants noted that key species might not be the best management focus if they are not locally widespread or present on the property.
- diversity at various scales
- public perceptions of environmental quality

Late successional forest characteristics might be undesirable where rare, unique, and important vegetation types occur or have the potential to occur. These vegetation types may include:

- Jeffrey pine grassland (habitat for candidate butterfly species property)
- western white pine
- knobcone pine
- Darlingtonia fens

3. Second-growth vegetation management for ecological objectives

This general area of discussion revolved around two questions:

1. Would desired future conditions be achieved absent intervention?
2. Can we accelerate the time to attain desired future conditions?

- Pertinent questions should be integrated into both planning and research objectives.
- long-term management for ecological objectives is ultimately an economic decision.
- Consider utilization of forest products (i.e. trees generated from thinning) as a source of funding for second-growth management strategies.

Second-growth management strategies should vary with (1) vegetation type (i.e. forests in the inland Rock Creek basin would necessitate different management than the coastal redwood forests in lower Mill Creek) and (2) Stimson's past industrial management applications (e.g., natural regeneration vs. planted).

There is good evidence that thinning increases growth and size, but does thinning accelerate attainment of a complex, diverse stand or forest?

- Research indicates that thinning does create future flexibility through lower tree density, increased overall vegetation structure, and increased resistance to disease and fire.
- The most cost-efficient approach may be to treat young stands (0 10 yr.) as evidenced by assessment of Mill Creek plots surveyed during appraisal.
- The number of reentries could be minimized by heavily thinning young stands to a wide spacing.
- In RNSP, natural thinning events in the 30 to 50 year age classes appeared to obtain the same goals as active intervention. This approach, however, would

likely require more time to attain late successional characteristics. If some areas are actively manipulated, it is essential that other areas remain unmanaged as control sites.

Stimson historically used herbicides to control brush and hardwood competition in young stands. Herbicide treatment of recently harvested stands may be unnecessary if hardwoods are a more desirable component of the forest ecosystem under park management. Herbicides may have significant effects on soil productivity and diversity. Herbicides may be more applicable for treatment of exotic and invasive plants.

Other potential experimental treatments include:

- fungal inoculation;
- creating snags by topping, stripping, and/or girdling trees within dense stands; and
- creating canopy gaps by knocking groups of trees down or control burning.

Other comments included:

- long-term second-growth vegetation management is largely an economic decision balancing available funding with the rate of succession toward desired future conditions;
- effective management requires a flexible decision-making process;
- second-growth vegetation management may be appropriate in some areas and not in others, these determinations should be based on individual site conditions;
- any program for second-growth vegetation management should maintain a full compliment of potential tools without excluding any methods until detailed site assessments are made; and
- the effectiveness of various management alternatives should be integrated into research objectives.
- concern that planting and seeding of redwood and Douglas-fir with stock from Washington state, Santa Cruz County, and others distant area may have caused genetic contamination. Genetic contamination is a larger concern with redwood than Douglas-fir. The problem may be limited by redwood propagation and limited seed dispersal. Redwood, however, may disperse more pollen when stressed. Treatment (e.g., replacement or containment) of genetically contaminated stands may be more damaging than the problem of contamination itself.

Participants also brought up the question of how the loss of productivity in Mill Creek may be compensated on a global scale, such as:

- increased demand for imported lumber,
- increased habitat disturbance and species extinctions in foreign countries with more forest product exports, and
- loss of wood fuels and other natural resources that locally sustain foreign, lumber-producing regions. Utilization of forest products generated by second-growth management practices on the property could mitigate global, regional, and local impacts while supporting the goals of the acquisition.

4. Vegetation management for fuels reduction and fire hazard reduction
Considerations for fire management planning:

- the road network serves as fire break and provides critical access;
- climate (i.e. humidity, wind, temperature, and soil moisture) has a large control on natural ignition, spread, and the ability to contain fire;
- the natural historic occurrence and frequency of fire may indicate where and how often fire can be expected in the future;
- the location of both natural ignition sources (e.g., lightning strikes) and introduced ignition sources (e.g., from public use) should be identified,
- vegetation management strategies should focus on reducing fuel loads and the fuel ladder.

Fire management planning should develop strategies to break up the size of potential fires and reduce the fuel ladder in areas connecting (1) high natural fire frequency (ridgetops in eastern portion of property) and high risk of artificial ignition (major access roads and public use area) with (2) areas of special concern. For example, fire management buffers could be created around areas of special concern such as old-growth stands and other biologically important areas.

Although fuels reduction and second-growth management should be coordinated, they should also be considered separately because strategies, prescriptions, treatment locations, and timing of treatments may differ.

5. Research

- Integrate management activities, monitoring, and research.
- Develop an advisory group of academic and agency representatives should to define research objectives and coordinate research activities.
- Focus on stand, watershed or subwatershed, and regional scales.
- Existing monitoring programs (i.e. downstream migrant trapping) should continue to be funded, and that long-term research plots are needed.
- Previously studied areas in the Bummer Lake Creek basin (1950-1960) could serve as long-term study sites.

Road and Aquatic Habitat Meeting

Stillwater Sciences

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MEMO

DATE: May 21st 2002

TO: Meeting participants

FROM: Stillwater Sciences

SUBJECT: **Notes from Mill Creek Road and Aquatic Habitat meeting May 8, 2002**

The following notes are not necessarily in chronological order. The notes represent statements made by one or more individuals in the group and do not necessarily represent the views of the group as a whole.

Meeting at the old mill site

The opportunities and constraints analysis for the road network is one of the most important to the interim management of the Mill Creek property due to the susceptibility of forest roads to surface erosion, mass wasting, stream crossing failure, and stream diversion. Furthermore, road use and maintenance integrates all other aspects of property management including fire management, second-growth forest management, public use, aquatic habitat protection, and monitoring.

Stillwater Sciences will identify strategies for minimizing road-related impacts based on a three-step process:

1. General strategies for minimizing the risk of episodic, storm-related road erosion will be identified. Strategies will emphasize low-cost methods of immediately minimizing stream diversion potential and crossing failure across the entire property.
2. High risk portions of the road network will be prioritized for interim treatment based on association with unstable slopes, location in middle and lower basin positions, location in watercourses and riparian zones, and contribution to high local road density.
3. Site-specific, high-priority sites will be identified based on 1995-1997 inventories by Pacific Watershed Associates (PWA). Stillwater

Sciences will identify sites that PWA characterized as having diversion potential, high erosion potential and high treatment immediacy.

The goals of this field meeting were to:

1. briefly review existing road design, use, and maintenance history.
2. identify the geomorphic processes acting on the road at different scales and basin positions.
3. identify erosion risks and potential impacts.
4. identify planning, design, and maintenance considerations for various types of road use.
5. identify appropriate or necessary uses for different parts of the road network during the interim time frame.
6. summarize past and present channel monitoring activities, and identify future geomorphic research and monitoring needs.
7. summarize the past and present fisheries monitoring activities, and identify future aquatic research and monitoring needs.

The road network was designed for industrial operations and was intensively maintained by Stimson crews up until about a year ago. Culverts on the property are generally undersized for the 50-year storm event. Most roads are insloped to inboard ditches with widely spaced drainage relief. Stimson employed as many as 7 people for road maintenance and construction work when the mill was operating at capacity. During the past decade or so, the road crew was reduced to 3 full time staff. Kevin Stowe estimated a $200,000/yr annual maintenance budget that included maintenance of equipment and fuel but did not include labor and equipment costs[1] Don Beers estimated that total costs would likely be 3-4 times Kevin's estimate if labor and equipment costs are included.

PWA inventoried erosion sites on the entire 250 miles of road in the Mill Creek and Rock Creek portions of the property between 1995-1997. Although the road erosion inventory accurately described the condition of the sites in 1995-1997, storm-induced and management-related site changes during the past 7 years necessitate another survey to accurately characterize existing conditions and prioritize road treatments.

Park staff plans to conduct an intensive road assessment to develop site-specific prescriptions. The assessment will include road inventories as well as detailed assessment of associated upslope erosion and drainage problems. The Park needs to quickly move forward with a transportation plan and road assessment. In the interim, the park should address

[1] An email from Scott Grey (Stimson) dated 11/28/00 included the following maintenance costs for 2001: grading $45k, culvert cleaning $20k, storm repair $10k, culvert installation $71k (plus $45k in materials), and bridge re-planking $10k. This totals $201,000. The annual maintenance portion is $85,000(grading, culvert cleaning, storm contingency, bridge re-planking) - with the balance of $116,000 associated with culvert replacement.

immediate road erosion and drainage problems before the next wet season by removing diversion potential through construction of rolling dips, outsloping, and reducing the erosion potential on road segments that pose the greatest risk to resources. The immediate priority for road maintenance is to avoid catastrophic road failures during the 2003 storm season. DPR should view the roads as a large liability that will require substantial investments to upgrade and keep stable.

Greg Bundros noted that the National Park Service did not take into account the need for road access for restoration forestry and monitoring work when the National Park decommissioned roads in Redwood Creek. Many areas where they would now like to conduct work or studies are difficult to access because the roads were removed. The State Park should consider all access needs during the initial planning effort.

Potential disturbance to marbled murrelet and northern spotted owls during breeding and nesting season is a concern. Enforcing limited operating periods and limited operating areas could limit disturbance. Jay Harris noted that a programmatic Environmental Impact Report (EIR) for road maintenance activities might be necessary. Kate Anderton noted that a mitigated negative declaration, if appropriate, was preferable due to the delays and costs associated with an EIR.

Natalie Schafer emphasized school involvement in research, monitoring, restoration, and outreach.

Stop 1: Hamilton entrance road.

Hamilton Road provides the only existing access to the property. This section of the road was rerouted to the north side of Hamilton Creek when a bridge failed during the November 1997 storm event. Sediment and wood originating from the failure damaged a portion of Picnic Road. The road was rerouted to a previous railroad right-of-way that traverses several deep-seated landslides contributing to chronic road instability. John Slette (former Stimson road crew) noted that this road needed grading about every 3 weeks during the winter.

Hamilton Road could be used to access the Mill Creek Campground if the existing Picnic Road is improved (see Stop 5). Minimum improvements for a vehicular connection between Hamilton Road and the Mill Creek campground would include several culvert replacements, stabilization of cut slopes and locations where the creek impinges on the road prism, and a bridge across the West Branch of Mill Creek.

Stop 2. Low-gradient portion of Childs Hill Road

Childs Hill Road is the mainline road that provides access from the old mill site to the East Branch of Mill Creek and the Rock Creek basin. The road surface is well rocked. A culverted crossing at Powderhouse Creek blocks fish passage, leaving about 400+ feet of habitat inaccessible. Chris Howard believes there are only two culverts that create barriers to fish

passage. PWA identified two potential barriers to fish passage.

Several participants restated the importance of preventing catastrophic road-related erosion during the interim period. Emergency inspections should occur in the winter. Inboard ditches will require winter maintenance to remove cut slope failures and other sedimentation that could divert concentrated flow over the road surface. Trash racks could be installed to reduce the potential for culvert plugging. Rolling dips could be installed at sites with high diversion potential.

Port Orford cedar root rot has been identified in the upper Bummer Lake Creek area. Transmission of the disease from adjacent park areas and private timber lands may have been limited by Stimson's exclusive use of onsite equipment.

State Park roads implementation staff stated that although there is a strong commitment to public access, vehicular access may be limited to Hamilton Road and the mill site in the interim period. Roads beyond this point may be closed to public vehicles due to public health and safety concerns. The remaining roads and trails may be limited to day-use hiking, equestrian, and biking opportunities.

Stop 3: Stream crossing on a steep portion of Childs Hill Road

The road is insloped and has a long inboard ditch with infrequent ditch relief. The stream crossing at this point shows evidence of past diversion down the inboard ditch and has a high potential for future diversion. Of the approximately 650 stream crossings in the 1995-1997 PWA inventories, about 30-40% were undersized for a 50-year storm and many were nearing the end of their lifespan and/or were damaged. The Park currently requires culverts to be sized for a 100-year storm event. Many Stimson roads have a high diversion potential. The culvert inlet area at this crossing was widened to create a detention basin. Wide inlet areas encourage sediment deposition and can allow woody debris to block the culvert opening.

There is a good rock surface on this portion of Childs Hill Road. Stimson utilized rock from onsite quarries. However State Park, due to regulatory concerns and the permitting process, may have difficulty quarrying rock onsite during the interim period. If so, Parks may need to haul rock from off-site at considerable expense. Rock could be salvaged from decommissioned roads or could be taken from quarry sites during reclamation.

Stop 4: Decommissioned road in the Rock Creek watershed

This road was decommissioned less than one year ago. Road decommissioning implemented during the last 18 months was intended to reduce the potential volume of road-related sediment sources at stream crossings while leaving the existing road bed between crossings in place

for reentry during future timber harvest operations. Stimson focused decommissioning efforts on high priority sites identified by PWA. Stimson has no implementation records for decommissioned sites.

Much of the fill has been removed from stream crossings, but the culverts remain in place. Low headwall heights create an increased risk of overtopping that could lead to failure of the remaining fill surrounding the culvert barrel. Tension cracks in the outer road surface between crossings indicate a continued potential for fill slope failure. These conditions are typical of many recently decommissioned roads on the property. There may be as many as 300 partially excavated crossings. The potential for sediment delivery from these recently decommissioned roads (approximately 60 miles) needs to be quickly assessed before vegetation makes access more difficult.

Stop 5. Picnic Road

The Picnic Road would connect Hamilton road to a large picnic area located on a broad alluvial terrace and would provide a loop road to the existing Mill Creek campground. The road, however, has a number of instability problems associated with cutbanks and fillslopes, has several culverted stream crossings, confines the West Branch of Mill Creek in several places, and would require a long-spanning bridge to reach the Mill Creek campground. The road has not been maintained during the last 9 years. This road may have limited impact on channel hydraulics and planform since the river flows unconfined within a wide alluvial valley.

Stop 6. Channel monitoring

The USGS monitored a stream gauge on the main stem of Mill Creek at the lower boundary of the Mill Creek property from 1974-1981. The USGS, in collaboration with the National Park Service, also established 11 monumented cross-sections throughout the Mill Creek watershed. The cross-sections were resurveyed during the summer each year between 1974 and 1980 nad most were resurveyed annually by the park service from 1982-1990. The cross sections on public land were resurveyed in the 1999. However, the cross sections on Stimson land have not been surveyed since 1990. Channel cross sections changed the most at pronounced breaks in gradient. Between 1984 and 1990, removal of a logjam and the replacement of a crossing with a bridge in the Mill Creek campground (1989) resulted in minor channel changes in this area 1990 and 1999 more aggradation and channel widening occurred in the Mill Creek campground area in response to large sediment inputs from upstream Between. All of the cross sections will be resurveyed during the coming summer. Jim Waldvogel felt that spawning gravel is presently in good condition.

The campground, located upstream within Del Norte Coast Redwoods State Park adjacent to the Mill Creek Park property, has problems associated with flooding, failed septic systems, and repeated culvert plugging along the entrance road. Future campgrounds should be sited

outside the 100-yr floodplain. Water for the campgrounds extracted from the Mill Creek channel and may impact summer lowflows. Impacts of water extraction to summer flow will be evaluated this summer.

Stop 6. Fish trap site on West Branch Mill Creek

Jim Waldvogel summarized data from adult escapement monitoring over the past 20 years. Chinook salmon escapement is generally greater than 50/mile and reflects good abundance and stocking. Jim also discussed age classes and the potential effects of water year types (i.e. wet vs. dry years) on Chinook runs. Chris Howard discussed juvenile salmonid production in Mill Creek and the annual monitoring of summer abundance and outmigration that began in 1993. Mill Creek appears to have excellent side channel and alcove habitat that provides refuge from high flow velocities. Large woody debris may be a potential limiting factor for juvenile salmonids. Alder currently dominates most riparian stands along Mill Creek. CDFG has been restocking riparian conifers along fish-bearing portions of Mill Creek during the past five years. Continuation of fish surveys at Mill Creek will cost about $93,000 a year. Fish monitoring is also needed in Rock Creek.

It was suggested that an interagency advisory committee be formed to prioritize and coordinate research and monitoring.

Visitors to the future Mill Creek park should be educated about the potential impacts of human disturbance on fish, particularly during the spawning season.
Harassment of fish can be avoided through seasonal creek closures, education, and outreach. Del Norte Schools are interested in these types of environmental programs.

PARTICPANTS IN THE PLANNING PROCESS

Name	Surname	Affiliation
Jim	Able	Consulting Forester
Kate	Anderton	SRL
Mark	Andre	City of Arcata
Leonel	Arguello	RNP
Don	Beers	DPR
Keith	Bensen	RNP
Chuck	Blackburn	Del Norte County
Jeff	Bomke	RNSP
Michael	Bowen	Coastal Conservancy
Amedee	Brickey	USFWS
Greg	Bryant	NMFS
Greg	Bundros	RNPS
Dan	Burgess	RHS
Tim	Burton	DFG
Michael	Camann	HSU
Laura	Chapman	Six Rivers NF
Bob	Connick	Councillor, SRL
Brent	Critch	NCRIA
Tom	Curtis	UC Berkeley
Peter	Dangermond	Councillor, SRL
Todd	Dawson	Councillor, SRL
Gary	Falxa	USFWS
Mitch	Farro	PCFWWRA
Gisela	Fritz	Stillwater
Eric	Gerstung	Councillor, SRL
Michelle	Gilroy	DFG
Roger	Goddard	DPR
Cyndy	Goodson	HRIA
Jennifer	Graves	NCRIA
Robin	Hamlin	USFWS
Jay	Harris	DPR
Ruskin	Hartley	SRL
Chris	Heppe	RNSP
Terry	Hofstra	RNP
Baker	Holden	RNP
Clarence	Hostler	NMFS
Chris	Howard	Simpson
Dave	Imper	USFWS
Nick	Kent	Councillor, SRL
John	Kolb	DPR
Karen	Kovacs	DFG
Sharon	Kramer	Stillwater
Steve	Kramer	Stillwater
Irma	Lagomarsino	NMFS
Zack	Larson	SRAC
Ron	LeValley	Mad River Biologists

Name	Surname	Affiliation
Bill	Libby	Councillor, SRL
Frank	Lynch	Del Norte Schools
Mary Ann	Madej	USGS
Walter	Mark	Councillor, SRL
Peter	Matzka	HSU
Dick	Mayle	RNSP
Laura	Mayo	Smith River Rancheria
Mike	McCain	Six Rivers NF
Lawrence	Merriam	Councillor
Brian	Merrill	DPR
Ken	Moore	DFG
Kevin	O'Hara	UC Berkeley
Vicki	Ozaki	RNSP
Ernie	Perry	Del Norte County
Hobie	Perry	HSU
Larry	Preston	DFG
Rick	Rayburn	DPR
Ron	Reuter	Stillwater
Jerry	Riley	Del Norte Schools
Andy	Ringgold	RNPS
Terry	Roelofs	HSU
Will	Russell	USGS
John	Sawyer	HSU
Natalie	Schaefer	Del Norte Schools
Rick	Sermon	DPR
John	Slette	Stimson
David	Solis	USFWS
Jay	Stallman	Stillwater
Roger	Sternberg	Consultant
Kevin	Stowe	Stimson Lumber Company
Dale	Thornburgh	HSU
Yana	Valachovic	UC Extension
Jim	Waldvogel	Smith River Advisory Council
Bill	Weaver	PWA
Ellen	Weaver	Councillor, SRL
David	Webb	Six Rivers NF
Frank	Wentworth	Councillor, SRL
Tom	Weseloh	Cal Trout
Roy	Wittwer	Councillor, SRL
Bill	Zielinksi	Redwood Sciences Lab

APPENDIX C - Species of special concern and additional species of interest

Amphibians

Del Norte Salamander

Federal Status None
State Status Protected, Species of Special Concern

Del Norte salamanders (*Plethodon elongatus*) occur in Humboldt, Del Norte, and Trinity counties in California and extend into southwestern Oregon. The species prefers older stands of redwoods, Douglas-firs, and mixed- conifer/hardwoods with forest floors that provide complex habitat such as talus, rocks, cut banks, logs, and leaf litter. The preferred substrate appears to be rock rubble with fine soils (Stebbins 1972, Welsh and Lind 1995). This salamander is found at elevations up to 760 m (2,500 ft) and does not require standing water. Del Norte salamanders are terrestrial and hide beneath downed wood and organic debris, which provides foraging habitat and protection from desiccation. They avoid stand edges with significant light penetration.

Del Norte salamanders are nocturnal. There is not much information available on their life history patterns. Eggs are laid on moist soil in spring and hatch in fall to early winter (Livezey 1959, Marangio 2002).

Del Norte salamander forage on annelid worms and small invertebrates, including springtails, beetles, spiders, flies, millipedes (Marangio 2002). They are probably preyed upon by small snakes.

Within the Mill Creek area Del Norte salamander are common, occurring mainly at higher elevations with hardwood-dominated forest stands of varying age classes (Stimson Lumber Company 1998). The substrate is characterized by organic debris and talus rock.

Del Norte salamanders were found in the following USGS quads (CNDDB 2000):

Crescent City	1991
Hiouchi	1998, 1991
Sisters Rock	*NA*
Childs Hill	1990/1991, 1993
Cant Hook Mountain	1989-1991, 1993

Southern Torrent Salamander

Federal Status None
State Status Protected, Species of Special Concern

Southern torrent salamanders (*Rhyactotriton variegatus*) occur in the coast ranges from the Little Nestucca River in northwestern Oregon to Point Arena in southern Mendocino County, California (Stebbins 1955, Good and Wake 1992, Jennings and Hayes 1994). The species is highly associated with redwood and Douglas-fir forests in the Pacific Northwest, and is generally restricted to seeps, springs, and higher-gradient reaches of small streams at elevations of up to 1,469 m (4, 819 feet) (Welsh and Lind 1996). Although adults are terrestrial, they usually do not occur more than 1 m (3 ft) away from running water with temperatures of 8 to 13ºC (46 to 55ºF) (Welsh and Lind 1996). They prefer dense canopy cover (>80%) (Nussbaum and Tait 1977), and cool moist microclimates found in late-successional forests. Although the species appears to be sensitive to substrate embeddedness by fine sediments (Welsh and Lind 1996), it may be able to compensate to some degree by favoring shallow stream microhabitats with steady flow where these occur in close association with cobble substrates (Welsh and Lind 1996, as cited in Welsh and Ollivier 1998).

Southern torrent salamanders forage on aquatic invertebrates, such as worms, snails, spiders, crustaceans, and insects (Nussbaum et al. 1983). Larvae may be preyed upon by Pacific giant salamanders.

The species appears especially sensitive to increased input of fine sediment, reduced riparian canopy cover, and reduced in-channel and riparian large woody debris (Welsh and Lind 1991, Welsh and Lind 1996, Diller and Wallace 1996).

Southern torrent salamanders are common within the Mill Creek area (Stimson Lumber Company 1998), where they are usually associated with closed canopies and high-gradient Class II streams (Jones and Stokes 1995); however, they have also been found in low-gradient streams.

Southern torrent salamander were also found in the following USGS quads (CNDDB 2000):

Crescent City	*NA*
Hiouchi	1989, 1991
Sisters Rock	*NA*
Childs Hill	*NA*
Cant Hook Mountain	1954, 1989/1990, 1992/1993

Foothill Yellow-legged Frog

Federal Status None
State Status Protected, Species of Special Concern

Foothill yellow-legged frogs (*Rana boylii*) range from northwestern Oregon to northern Baja California, west of the Cascade crest in Oregon, south to the California coast range, and in the western Sierra Nevada foothills to Los Angeles and San Bernardino counties (Blaustein et al. 1995). It occurs at elevations of up to about 1, 900 m (6, 300 ft).

The species inhabits streams with shallow riffles, partial shade, and cobble-sized or larger substrate (Hayes and Jennings 1988). It appears that intermediate levels of shade are preferred in a variety of habitats (Zeiner et al. 1988). Tadpoles prefer more open areas with abundant algal food resources (Kupferberg 1996). Breeding habitat is characterized by bars with cobbles or bedrock with laminar flow (M. Hayes, pers. comm., 2000). Foothill yellow-legged frogs forage along the edges of rocky pools and within streams (Nussbaum et al. 1983). One of the primary requirements for breeding habitats are low-flow, warm-water nursery sites.

Foothill yellow-legged frogs forage on aquatic and terrestrial invertebrates, such as snails, flies, moths, beetles, and ants, and tadpoles of Olympic tailed frogs, *Ascaphus truei.* Tadpoles are herbivorous and prefer feeding on epiphytic diatoms, therefore they prefer channels with warmer water over small headwater tributaries.

The species appears to be uncommon in the Mill Creek area, although several creeks within the area appear to contain appropriate habitat (Stimson Lumber Company 1998).

Foothill yellow-legged frogs were also found the following USGS quads (CNDDB 2000):

Crescent City	*NA*
Hiouchi	*NA*
Sisters Rock	*NA*
Childs Hill	*NA*
Cant Hook Mountain	1993

Northern Red-legged Frog

Federal Status None
State Status Protected, Species of Special Concern

Red-legged frogs (*Rana aurora aurora*) occur west of the Cascade Range and Sierra Nevada from British Columbia, Canada south to northern Baja California. Northern red-legged frogs occur from Sullivan Bay, British Columbia south to northern Humboldt County, California.

This species uses a variety of habitat types including aquatic sites used for breeding, riparian and mesic upland forests inhabited during the post-breeding season, and upland habitats used during overwintering at low elevations (Licht 1969, Nussbaum et al. 1983, Gomez and Anthony 1996). Deep water pools are used as call stations at depths of at least 92 cm (3 ft) (Licht 1969) and for protection from predation (Gregory 1979, as cited in Davidson 1993).

Red-legged frog tadpoles are herbaceous grazers on algae. The adults prey on terrestrial and aquatic invertebrates including beetles, spider, crustaceans, and mollusks (Blaustein et al. 1995). Northern red-legged frog larvae are mainly preyed upon by rough skinned newts and northwestern salamanders (Jennings and Hayes 1994). Rainbow trout, damsel and dragonflies, and giant diving bugs feed on the tadpoles (Calef 1973, Licht 1986). Adults are preyed on by wading birds (Jennings and Hayes 1994).

Potential threads to the northern red-legged frogs are timber harvest, urban development, livestock grazing, and predation from introduced fish species and bullfrogs. Effects of timber harvest include isolation of populations, decrease of suitable habitat, and changes in water quality.

The species is common in the Mill Creek area (Stimson Lumber Company 1998). Watershed areas with dense vegetation and humid forest stands provide ideal conditions for the red-legged frog. Highest-quality habitat is found in the West branch of Mill Creek. It is believed that the species does not to occur east of Childs Hill nor west of the highest ridge in the Mill Creek area.

Olympic Tailed Frog

Federal Status None
State Status Protected, Species of Special Concern

Olympic tailed frogs (*Ascaphus truei*) are known to occur from the central coast of British Columbia (Dupuis et al. 2000), through the western Oregon and Washington, and south to northern California. Within California, tailed frogs occur in coastal forests and areas with specific set of habitat conditions of the northwestern portion of the state from Del Norte County south to central Sonoma County and as far east as the southwest portion of Shasta County (Bury 1968, Stebbins 1985, Jennings and Hayes 1994).

The species occurs at elevations over 1,980 m (6,500 ft) in forested areas with almost 100% cover and generally high annual precipitation. Tailed frogs have one of the narrowest ranges of temperature tolerances and live typically live in waters between 5º and 16ºC (41º and 61ºF). Larvae prefer habitats with cobble, boulder, and gravel substrates and are negatively associated with fine substrates. Diller and Wallace (1999) concluded that Olympic tail frog distribution is not necessarily tied to old-growth forest, but to specific microhabitats that are more likely to occur in undisturbed areas. Some of these attributes of stand structure include low ambient temperatures resulting from high canopy closure, downed woody debris, particularly in and around streams, low light conditions, and a duff layer that filters clearer, cooler

water and maintains cool, moist streamside microclimates. Due to their narrow habitat requirements, tailed frogs are sensitive to extirpation (Welsh 1990, Bury and Corn 1988).

Olympic tailed frogs are primarily dependent upon epilithic diatoms (Franz 1970, Altig and Brodie 1972, Nussbaum et al. 1983), but incidentally also eat filamentous algae, tiny insects, and conifer pollen. They are preyed upon by garter snakes, fish, giant salamander, American dippers, and dobsonfly larvae (Metter 1963, Daugherty and Sheldon 1982, Feminella and Hawkins 1994, Jones and Raphael 1998).

Surveys for tailed frogs were done on randomly selected watersheds and opportunistic during surveys conducted for THPs (Stimson Lumber Company 1998). The species appears to be common within the Mill Creek area and associated with rich invertebrate life in Class II and Class I streams fed by cool groundwater (Stimson Lumber Company 1998). They occur in a wide range of stand structures within the Mill Creek property; however, they were mainly associated with dense canopy cover and a cool, moist microclimate.

Tailed frogs were also found in the following USGS quads (CNDDB 2000):

Crescent City	*NA*
Hiouchi	1989, 1991
Sisters Rock	*NA*
Childs Hill	1990, 1993
Cant Hook Mountain	1989, 1992/93

Fish

Descriptions of anadromous salmonid species occurring in the Mill Creek watershed are included in Section 2.7.2.

Green Sturgeon

No status

Green sturgeon (*Acipenser medirostris*) are found in many of the major coastal river systems in California from the Sacramento River north to the Smith River, where adults have been observed in Lake Earl and inland on the Middle Fork of the Smith River near Patrick's Creek (Stimson Lumber Company 1998). No spawning has been documented in the Smith River drainage, however, and no juveniles have been found. It is not known whether green sturgeon occurs in Mill Creek. Juvenile salmonid outmigration trapping on the West Branch and East Fork, adult spawning surveys, and dive surveys, conducted since 1994, have not detected green sturgeon in the Mill Creek drainage (Stimson Lumber Company 1998).

The habitat requirements of green sturgeon are not well known, but are generally believed to be similar to white sturgeon (*A. transmontanus*). Juveniles and adults are benthic feeders, but may also prey on small fish (Moyle 2002). It is believed that green sturgeon spend the majority of their lives in nearshore oceanic waters, bays, and estuaries (NMFS 2002). Early life-history stages (<4 years old) reside in fresh water, with adults returning to freshwater to spawn when they are more than 20 years of age and more than 130 cm in length. Green sturgeons have historically spawned in the Fraser, Columbia, Umpqua, Eel, South Fork Trinity, and San Joaquin river systems. Under current conditions, however, green sturgeon are thought to spawn only in the Klamath-Trinity and Sacramento River systems and possibly the Rogue River. Most of the spawning is thought to occur in the Klamath-Trinity River and only limited spawning in the Sacramento River. Green sturgeon in the Klamath River migrate between February and late July with the peak spawning period from mid-April to mid-June.

The existing spawning populations are thought to be relatively small and they occur in river systems that have dams, water project operations, and other land use practices, which potentially threatened these populations through the loss or degradation of habitat. In addition, the green sturgeon is harvested, generally as by-catch, in fisheries that occur in coastal Washington, the Columbia River, and the Klamath River. Only the remaining spawning populations that occur in California likely support the harvest of green sturgeon, in the coastal Washington and Columbia River fisheries.

There is concern that the North American green sturgeon may not be able to sustain the current level of impact from existing fisheries given their life-history characteristics and the limited number and size of the current spawning populations. On June 12, 2001, NMFS received a petition from the Environmental Protection Information Center (EPIC), the Center for Biological Diversity, and the Waterkeepers Northern California requesting that they list the North American green sturgeon as either a threatened or an endangered species under the ESA, and that they designate critical habitat for the species concurrently with any listing determination. In the 90-day finding on the petition published in the *Federal Register*, NMFS determined that the petition presents substantial scientific and commercial information indicating that the petitioned action may be warranted, and also solicited information and comments pertaining to the species.

NMFS is expected to promptly initiate a status review for green sturgeon. The ESA provides one year from the date the petition was received (i.e., by June 12, 2002) to complete the review process and for NMFS to publish its findings and decision whether to propose listing the species as threatened or endangered under the ESA.

River Lamprey

Federal Status None
State Status Species of Special Concern

In California, river lamprey (*Lampetra ayresi*) have been reported from the lower Sacramento-San Joaquin Rivers, the Napa River, Sonoma Creek, and Alameda Creek. However, they have not really been looked for in other streams so their current distribution is uncertain (Moyle 2002). Throughout their range, from San Francisco Bay to Juneau, they apparently exist as widely scattered and isolated populations (Moyle 2002). River lampreys are anadromous, spawning in fresh water and rearing for 3-5 years as larvae, or ammocoetes. River lamprey die after spawning. Spawning timing and requirements are poorly known in California (Moyle 2002). Adults apparently spawn during February through May in tributary streams and require clean gravel riffles.

Lampreys have been commonly observed in the Mill Creek drainage spawning surveys and juvenile outmigration trapping since 1994. During the same period, no lamprey or ammocoetes have been observed in the Rock Creek drainage. However, lamprey that were observed or captured during these surveys were not been identified to species. Although the presence of river lamprey has not been confirmed, most of the streams in the Mill Creek property, except for Rock Creek, appear capable of supporting populations of river lamprey (Stimson Lumber Company 1998).

Pacific Lamprey

No status

In California, Pacific lamprey (*Lampetra tridentata*) are found in most major drainages and tributaries that support runs of anadromous salmonids. The southern distribution may include intermittent populations as far south as northern Baja California. Adults are predators and attack marine fish. Pacific lamprey are anadromous, returning from the sea only to spawn in the spring. Usually both sexes die after spawning but cases of repeat spawning have been reported (Moyle 2002). Embryos hatch in about 19 days at 15°C. The larvae (ammocoetes) are filter feeders and remain in freshwater backwater areas and stream edges for an extended period of 5 to 6 years. Cool temperatures are preferred.

Lampreys have been commonly observed in the Mill Creek drainage during spawning surveys and juvenile outmigration trapping. However, lamprey that were observed or captured during these surveys were not been identified to the species level. Although the presence of Pacific lamprey has not been confirmed, most of the streams within the Mill Creek property are likely capable of supporting populations of Pacific lamprey. Rock Creek is the exception since no ammocoetes or adult lampreys have been observed during surveys since 1994.

Birds

Double-crested Cormorant

Federal Status None
State Status Species of Special Concern

Double-crested cormorants occur on both coasts from Alaska and Nova Scotia to Mexico and the Bahamas (Cogswell 1977). They overwinter north to southern Alaska and southern Nova Scotia. Cormorants occur in California year-round along the coast and on inland lakes and rivers. They are found in fresh, salt and brackish water.

Roosting habitat is also used for nesting in undisturbed areas associated with nearby foraging areas with abundant food supply, and include islands, bridges, transmission towers, and trees surrounded by marshes or salt ponds (Harvey et al. 1992). Cormorants feed on a variety of fish, including carp, smelt, perch, suckers, and sculpins (Cogswell 1977). The cormorants avoid shallow water and need distance for long take-off flights.

Double-crested cormorants have been observed for limited time in a holding pond in the Mill Creek area. However, the Mill Creek area does not provide many large bodies of water with riparian vegetation. Although some of the low-gradient streams may provide foraging habitat they are not of high quality due to the lack of deep water. Some trees, including redwoods, might provide roosting habitat, however, cormorants prefer to roost close to foraging habitat.

Double-crested cormorants were also found in the following USGS quads (CNDDB 2000):

Crescent City	*NA*
Hiouchi	*NA*
Sisters Rock	1986
Childs Hill	1986
Cant Hook Mountain	*NA*

Great Egret

Federal Status None
State Status None
California Board of Forestry Species of Concern

Great egrets (*Ardea alba*) occur mainly along the California coast, central United States, and along the east coast. They prefer nesting in tall trees, however, will also nest in lower vegetation such as marsh grass and thickets. The species is very sensitive to human disturbance during nesting. Egrets feed primarily on fish and invertebrates, and to a lesser extent on insects and small mammals. Foraging habitat include mudflats, pasturelands, and marsh areas.

Great egrets are rarely observed in the Mill Creek area. They are abundant in the Smith River area and the nearest breeding rookery is in Humboldt County. Low-gradient streams in the Mill Creek area could provide foraging habitat for great egrets. However, overall conditions are only marginal due to lack of lentic waters and wetland areas (Stimson Lumber Company 1998).

Northern Goshawk

Federal Status None
State Status Species of Special Concern

Northern goshawks (*Accipter gentilis*) occur throughout the northern hemisphere almost as far south as the sub-tropical regions. Within North America, they breed from Alaska to Newfoundland and south (Squires and Reynolds 1997). In the northern areas they are partly migratory, probably related to food availability. Every ten years, following the low population cycle of snowshoe hares and grouse, the migration south is more extreme (Doyle and Smith 1994). The species is mainly associated with dense late-successional conifer forests characterized by dense canopy closure and north facing slopes.

Nesting habitat is characterized by mature stands of uneven age. Nest areas are about 10 ha (30 ac) and usually show no signs of recent timber harvesting. Large trees, moderate slopes, and open understory are preferred. Nest activities, such as nest repairs and breeding start between February and early April. Goshawks require large home ranges averaging 2,007 ha (6,000 ac) with post-fledgling areas of over 60% suitable forest habitat.

Goshawks forage at the forest edge and interior and especially males tend to travel long distances while foraging (Squires and Reynolds 1997). The main prey items are birds and mammals. Although considered a forest bird, foraging capabilities are limited in dense over- and understory canopies.

Goshawks are sensitive to human disturbance especially during nesting. Timber activities as well as recreational activities such as camping within 50 to 100 m (164 to 328 ft) of the nest can cause failure during incubation, but can also cause abandonment of the young (Boal and Mannan 1994, Speiser 1992).

The species was reported twice within the Mill Creek area (Stimson Lumber Company 1998). An adult was observed in 1994 and a juvenile in 1995. No nesting areas are known in this area probably due to dense understory. However, redwood and montane riparian forest with moderate or dense canopy closure could provide foraging habitat for northern goshawks if understory and ground cover is not too dense to inhibit foraging. Goshawks are not recorded nesting in redwood forest, but could use montane riparian forest stands, which contain a mix of deciduous and coniferous species.

Sharp-shinned Hawk

Federal Status None
State Status Species of Special Concern

Sharp-shinned hawks (*Accipiter striatus*) winter in the central United States and Costa Rica and breed in Canada and Alaska below the tree line, and in the western United States south to Central America.

The species prefers deciduous riparian habitat and young dense stands 25 to 50 yrs with high canopy closure and sparse ground cover. An increase in abundance can be observed with increasing stand size and presence of hardwood, while abundance decreases with increasing clear-cutting. Sharp-shinned hawks have home ranges between 53.5 to 334.5 ha (160 to 1,000 ac) (Cornell Lab of Ornithology 2002).

Sharp shinned hawks are powerful flyers, which are capable of rapid flight through dense vegetation. They take primarily birds (90 to 97%). and prey taken by females can weigh up to 60% of their body weight (Cornell Lab of Ornithology 2002).

Sharp-shinned hawks are commonly breeding in the Mill Creek area. Major prey items such as interior and edge-dwelling birds occur in high abundance providing forage opportunities. Nesting and foraging habitat are available in large blocks of dense second-growth forest, although nest stands typically have interior forest conditions (e.g., 91 m (> 300 ft) from forest edge).

Cooper's Hawk

Federal Status None
State Status Species of Special Concern

Cooper's hawks (*Accipiter cooperii***)** breed from southern Canada south to central California and northern Mexico. They winter in the southern part of their range, although residents of the southern range may be year-round, whereas those of the northern range are more migratory.

Preferred breeding habitat includes coniferous and deciduous riparian forests, oak woodland, young and mid-successional even-aged stands of 30 to 70 yrs with dense overstory canopy (Remsen 1978, Asay 1987). Dense stick platform nests are usually about 3 to 24 m (10 to 80 ft) above ground. However, the species likes some openness near streams and open waters for foraging. Its home range size is about 295 ha (730 ac).

Cooper's hawks are powerful flyers that can take prey on the ground, in flight, or in trees. Their diet consists of small birds, mammals, and reptiles. It appears that Cooper's hawks can tolerate fragmented forests and forest edge (Johnsgard 1990). Some reports indicate successful breeding in suburban and urban areas. However, grazing and agricultural activities affect small bird populations and leads to a decline in the prey base. Furthermore, take of young birds for falconry appears to have effects on the decrease of the population (Remsen 1978).

Cooper's hawks are commonly breeding in the Mill Creek area. Preferred foraging habitat appears to be young second-growth mixed forest with sufficient openings and edge habitat. Cooper's hawks nest in a wide variety of forest conditions from extensively forested wilderness to small fragmented woodlots. Mid-successional second-growth coniferous forest and deciduous riparian groves are provided throughout the Mill Creek area.

Golden Eagle

Federal Status None
State Status Species of Special Concern

Golden eagles (*Aquilla chrysaetos*) are found throughout the United States (Small 1994). They are associated with a variety of habitats, including mountainous areas, and especially in the winter, shrub-land, and grasslands. As they are fairly large birds they require open areas to hunt for their prey.

Nesting requires large trees or cliffs where a large nest is built with sticks. One to four eggs are laid. The female mainly incubates the eggs, feeds and tends the young, while the male provides the food (Small 1994). Golden eagles prey primarily on mammals such as rabbits and larger rodents, but also on birds and reptiles.

The principal threat to the golden eagle is habitat destruction and fragmentation as well as shooting by ranchers, power line electrocution, and poisons intended for coyotes (Ehrlich et al. 1992).

Golden eagles have only been observed once within the Mill Creek area in 1994 (Stimson Lumber Company 1998). Several other sightings occurred outside the area in Del Norte County and Humboldt County.

The absence of the species is assumed to be due to lack of open habitat. Only recent harvest areas could provide enough open space to be used as foraging habitat due to the rapid regeneration of coniferous and deciduous vegetation.

Ruffed Grouse

Federal Status None
State Status Species of Special Concern

Ruffed grouse (*Bonasa umbellus*) occur throughout forested areas of the Pacific Northwest and the northern-most counties of California. The species prefers deciduous riparian areas as breeding habitat. Ruffed grouse forage in adjacent conifer and hardwood forests, which they also use for cover. Logs are used as drumming platforms.

Home ranges are on average 67 ha (165 ac) in spring and summer and 104 ha (257 ac) for fall and winter. During the summer the grouse feeds on insects, seeds, fruits and sometimes, a small snake or frog; the winter diet is much more limited consisting of buds and catkins. A shallow, sheltered depression lined with leaves and filled with 9 to 12 pinkish-buff, plain or spotted eggs characterizes the nest.

Ruffed grouse are not common in the Mill Creek area. However, two breeding pairs have been observed. It is possible that the species is more abundant than thought but due its secretive behavior and camouflaged plumage it often not detected. Use of coniferous stands is restricted to those near areas of deciduous vegetation. Within the Mill Creek area, ruffed grouse habitat would be restricted to montane riparian stands that support deciduous vegetation and conifer stands (Stimson Lumber Company 1998).

American Peregrine Falcon

Federal Status None
State Status Endangered

The peregrine falcon (*Falco peregrinus anatum*) formerly bred over most of North America, from the northern tree line south to Baja California. This species has reoccupied most of its historical breeding range in California, including the Channel Islands, the Coast and Cascade ranges, and the Sierra Nevada. Peregrine falcons inhabit all counties in the state at various times of the year (Gertsch et al. 1994). While breeding pairs tend to remain near their territories throughout the year, immature and non-breeding individuals may migrate considerable distances. Large itinerant populations appear throughout California from late September through early May in areas of high prey densities (Gertsch et al. 1994). In northwestern California, this species is an uncommon migrant and winter visitor, and a rare, local nesting species and summer resident (Harris 1996).

Peregrine falcons prefer open areas along rivers, lakes or coast, but have successfully adapted to cities. Nesting sites are typically on ledges of large cliff faces, but some pairs nest on city buildings and bridges. Peregrine falcons will also, on rare occasions, appropriate stick nests from a variety of large birds such as bald eagles; these nests can be found in either dead or living trees (Palmer 1988 in Shuford 1993). Nests consist of depressions with accumulated debris. They are used for many years and are located from 15 m

to over 61 m (50 to over 200 ft) above ground and can occur from sea level to 3,386 m (11,100 ft) elevation. Nesting and wintering habitats are varied, including wetlands, woodlands, and other forested habitats, cities, agricultural lands, and coastal habitats (Gertsch et al. 1994), although nest sites are usually located near water (Zeiner et al. 1990a).

Foraging habitat includes a variety of open space areas such as wetlands, bottoms, estuaries, mudflats, marshes, meadows, lakes, and rivers (Porter et al. 1973). In coastal areas, peregrine falcons forage predominantly around estuaries and seabird colonies (Shuford 1993). In the course of this literature review, coniferous forests were not found to be commonly used by peregrines as foraging habitat.

Peregrine falcons feed almost exclusively on other birds, usually pigeons, songbirds, shorebirds and waterfowl, which they kill in midair with blows from their talons. They will switch their preferred prey in years of high lemming and vole populations. Females are larger then males and therefore can hunt larger prey. Cooperative hunting has been observed with the female diving for the prey first and also later eating first. Young falcons may be preyed upon by golden eagles, great horned owls, raccoons, and other mammals. In addition, peregrine falcons compete with ravens and other falcons for nest sites.

From the 1950s to 1970s, use of the organochlorine insecticide DDT caused eggshell thinning and breakage, causing a significant decline in peregrine falcons (USFWS 1995b). Although peregrine falcons are generally considered to be recovering from DDT (USFWS 1995b), there is still a possibility that further impacts could occur in the future, due to the use of dicofol (trade name Kelthane), a legal and widely used U.S. pesticide that is manufactured from DDT and contains a proportion of the unadulterated parent material, illegal use (Bonney 1986, Ehrlich 1992), and use in Mexico and South America, thereby potentially contaminating migratory species such as ducks and shorebirds that are eventually preyed on by peregrine falcons and other raptors (Mora 1997). In addition to problems with organochlorines, peregrine falcons are very sensitive to human disturbance around nest sites (Shuford 1993), which can lead to abandonment of eggs or young.

No peregrine falcon nests have been found within the Mill Creek area probably due to the absence of cliffs. The nearest observed nesting habitat exists on offshore islands. However, wintering peregrine falcons have been observed in non-forested areas at Lake Earl and the Smith River bottoms. Foraging habitat within the Mill Creek is limited due to the lack of open areas. Recent clearcuts could provide the only foraging opportunities for peregrine falcons (Stimson Lumber Company 1998).

Purple Martin

Federal Status None
State Status Species of Special Concern

Purple martins (*Progne subis*) are neotropical migrants that breed from southern Canada to northern Mexico, however in northwestern California they are uncommon summer residents and nesting species (Harris 1996).

During the nesting season purple martins prefer coniferous forests that have large snags with cavities (Shuford 1993, Small 1994, Brown 1997). The nest tree itself is often found in a natural fire-created or human-made forest clearing (Shuford 1993). In addition, they choose nest sites in prominent positions such as ridges and hilltops (Williams 2001). Purple martins are associated with old trees, but in more open stands.

Purple martins feed on a large variety of aerial insects including beetles, dragonflies, flies, butterflies, bees and spiders (Brown 1997). Nesting adults and young are preyed upon by snakes, owls, corvids, squirrels, and raccoons. Furthermore, hawks and great blue herons catch adults in the air. Purple martins compete with house sparrows and European starlings for nest sites especially on the east coast. Foraging habitat exists over riparian areas and early-successional stands adjacent to old-growth.

Purple martins are common in the Mill Creek area. Although no open shoreline or large burns are present, large snags are available in remaining late-successional habitats and scattered clumps throughout the Mill Creek area. Purple martins are most commonly observed on the border between Redwood National Park and the Mill Creek area.

Vaux's Swift

Federal Status None
State Status Species of Special Concern

Of the five subspecies of Vaux's swift (*Chaetura vauxi*), only *C. v. vauxi* breeds in western North America, predominately in the coastal range south to Mendocino County. The species arrives on the breeding grounds mid April to mid May, and leaves mid August to early September. Overwintering in California is rare but occurs from Lake Earl in Del Norte County (Harris 1996) to Monterey County (Roberson 1985), and in southern California (Garrett and Dunn 1981). The birds usually overwinter from central Mexico to Venezuela (Sterling and Paton 1996). The Vaux's swifts occur in coniferous forests along the central and northern California coast. They are found in coastal redwoods between sea level and 762 m (2, 500 ft), and prefer redwoods, Douglas-fir, and ponderosa pine (Sterling 2002). They prefer natural cavities and burned-out hollow trees as nest sites (Small 1994).

Vaux's swifts feed primarily on aerial insects and spiders (Bull and Collins 1993) and forage above the forest canopy, and but also at lower levels in meadows, over lakes, rivers and ponds. Unseasonably cold, wet weather during migration and breeding likely reduces insect availability, resulting in starvation of both adults and nestlings (Bull and Collins 1993). It is probable that small mammals and snakes prey on nestlings and eggs by taking them from the nest (Sterling 2002).

Timber harvesting of large diameter trees removes present and potential future nest and roost trees (Bull and Collins 1993). Fire suppression eliminated the natural creation of snags (Morrison and Swanson 1990, Finney 1996).

There are no records of Vaux's swift presence within the Mill Creek area. However, complex old-growth stands with snags and old trees with natural cavities could provide nesting habitats. Streams and associated riparian areas, especially Mill Creek, could provide sufficient suitable foraging habitat.

Yellow Warbler

Federal Status None
State Status Species of Special Concern

Yellow warblers (*Dendroica petechia*) fit into three main groups with the yellow warblers occurring in California belonging to the *aestiva* group (Dunn and Garrett 1997). Historic breeding records for *D. p. brewsteri* include Crescent City, Del Norte County (Grinnell and Miller 1944). Currently Yellow warblers breed at 23 sites in the Klamath and Trinity watersheds, Siskiyou County (Klamath National

Forest 1992-1997 data). Suitable habitat includes nest sites, concealing cover, singing posts, foraging areas, as well as open space (Kendeigh 1941). They hold home ranges from 0.03-1.62 ha (0.07-4 ac) and prefer riparian plants and broad-leafed trees (Grinnell and Miller 1944).

Yellow warblers breed after their first winter (Zeiner et al. 1990a). They show high site fidelity ranging between 32% for females up to 73% for males (Studd and Robertson 1989, Knopf and Sedgwick 1992). Clutch size is usually 3-6 eggs that are incubated up to 12 days after the clutch is completed by the female (Ehrlich et al. 1988).

The species feed on mainly animals (97%) such as ants, bees, beetles, flies, spiders, and other insects (Beal 1907). Nest-predation, parasites (such as the brown-headed cowbird), and depredation result in nest failure (Knopf and Sedgwick 1992, Rogers 1994).

Yellow warblers arrive in northwestern California mid to late April (Dunn and Garrett 1997), but there is no data on their departure time from this region. Only single birds have been observed overwintering (Harris 1996, Small 1994).

Yellow warblers have been observed infrequently within the Mill Creek area along low- and moderate-gradient portions of Mill Creek. In these sections, alder, salmonberry, maple and other deciduous vegetation create a thick tangle where the warbler has been found to nest and feed. The species has not been observed outside riparian areas, although brushy habitats also occurs upslope.

Yellow-breasted chat

Federal Status None
State Status Species of Special Concern

The western subspecies of yellow-breasted chat (*Icteria virens auricollis*) breeds from southern British Columbia and Saskatchewan to southern California and western Texas (Pyle 1997). The bulky nests are cup-shaped and well hidden in vegetative structures, and about 1 m (3 ft) above ground in dense patches of wild vines and blackberries (Petrides 1938, Dunn and Garrett 1997). Yellow-breasted chats are simply monogamous, but successive monogamy and polygany occur as well (Thompson and Nolan 1973). The female usually lays and incubates 3-4 eggs (Petrides 1938). Both parents tend the young (Ricketts et al. 2000). There can be 2 broods a season.

Territories are on average 1.24 ha (3.7 ac), but can shift during the season depending on the number of surrounding home ranges (Thompson and Nolan 1973). In California, chats require dense riparian vegetation associated with streams, swamps, and small ponds (Small 1994). Taller trees, such as cottonwood and alders, are used as perches (Dunn and Garrett 1997). Several studies indicate that the species is associated with clearcuts (Annand and Thompson 1997) and brushy edge habitat along powerlines (Kroodsma 1982), and specifically dense blackberry patches (Kroodsma 1982, Burnhans and Thompson 1999, Ricketts 1999).

The species feeds on insects and berries by gleaning foliage (Ehrlich et al. 1988). Food items include small fruits from plants such as honeysuckle, blackberry, mulberry, sumac, and nightshade (Dunn and Garrett 1997). Potential nest predators in California include jays, dusky-footed woodrats, raccoons, and several species of snakes (Ricketts et al. 2002).

Yellow-breasted chats arrive at their northern breeding grounds from late April to early May and leave between August and September (Ricketts et al. 2000). No information is available specifically on winter

distribution of the western subspecies; in general, the species winters in the lowlands of the Pacific and Atlantic slopes of Mexico and Central America (Dunn and Garrett 1997).

Several yellow-breasted chats have been observed in the Mill Creek area between June and September 1994, primarily along portions of Mill Creek where dense shrub layers dominate the understory. Because of the abundance of riparian habitat with dense understory of blackberry, salmonberry, and red alder, chats are expected to be a regularly breeding species on the property.

Dense thickets of exotic Himalayan blackberry may be used as nesting habitat by yellow-breasted chats in California (Zack et al. 1997, as cited in Ricketts et al. 2002). Management efforts to remove this exotic plant from riparian areas should consider potential effects on locally breeding chats (Ricketts et al. 2002). Because of their dependence on dense riparian vegetation, yellow-breasted chats may be adversely impacted by disturbances to these habitats (Ricketts et al. 2002). Such disturbances may include (1) silvicultural practices that reduce understory vegetation, (2) recreational activities that result in trampling and removal of riparian plants, soil compaction, and bank erosion, and (3) livestock grazing. Yellow-breasted chats are very vulnerable to nest parasitism by brown-headed cowbirds; however, there is a lack of information on parasitism rates in California (Ricketts et al. 2002). Because brown-headed cowbirds tend to be found in disturbed habitats (Ehrlich et al. 1988), development of recreational facilities may increase nest parasitism in adjacent riparian areas. Cowbirds generally avoid continuous forest habitat; therefore, substantial detrimental impacts on yellow-breasted chats in the Mill Creek area may be unlikely to occur.

Mammals

California Red Tree Vole

Federal Status None
State Status Species of Special Concern

The California red tree vole (*Arborimus pomo*) is distributed along the Pacific coastal lowlands in Oregon and northern California. In California, it is restricted to coastal forests in the humid fog belt north of San Francisco Bay to the Oregon border (Williams 1986, Jameson and Peeters 1988) to elevations of 1,600 m (5249 ft) (Manning and Maguire 1999). Red tree voles are predominately nocturnal and active all year (Zeiner et al. 1990b). This arboreal species lives, nests, and feeds within the forest canopy; only males are partly terrestrial (Williams 1986). Vole nests are mainly found in old-growth forests, including large diameter Douglas-fir trees, high percent canopy cover, high stump density, low snag density, shorter snags and downed logs, and lower elevations. (Meiselman and Doyle 1996). Nests, made of Douglas-fir needles, are located 6 to 18 m (20 to 60 ft) above ground, preferably in Douglas-fir trees (Williams 1986). Breeding occurs throughout the year, but mainly from February through September. Litter size averages two with one or more litters per year. The difficulty in converting conifer needles to metabolic energy appears to be responsible for the long reproductive period, small litter size, slow juvenile development, and extended nursing, which results in a very low annual reproductive rate when compared to most rodent species (Carey 1991).

California red tree voles feed on needles, buds, and tender bark of twigs of Douglas-fir, western hemlock, grand fir, bishop pine, and other species (Williams 1986, Wooster 1996, as cited in Corn and Bury 1991). Spotted owls (Forsman 1976, as cited in Carey 1991), northern saw-whet owls (Forsman and Maser 1970, as cited in Carey 1991), and long-eared owls (Reynolds 1970) prey on red tree voles.

Although California red tree voles have been recently documented as being more adaptable than earlier reports indicate (Wooster 1996), loss of habitat and habitat fragmentation resulting from timber harvesting, forest fires, and clearing for agriculture and home sites represent the primary threats to the California red tree vole (Williams 1986, Huff et al. 1992).

Red tree voles have been observed in the western portion of the Mill Creek area (Stimson Lumber Company 1998). Patches of habitat are located in residual late-successional stands and older second-growth forest. However, most of these stands do not contain the tree species eaten by the red tree vole and are not likely to support the species. Many of these areas were intensively surveyed (Jones and Stokes 1995) and no evidence of voles found. Within the Mill Creek area, late-successional forest exists in isolated fragments and probably does not support red tree vole populations. The large block of second-growth forest on the west side of the property supports habitat and is contiguous with neighboring public land. This is the only stand in which the red tree vole is known to occur on the Mill Creek property.

Red tree voles were also found in the following USGS quads (CNDDB 2000):

Crescent City	*NA*
Hiouchi	*NA*
Sisters Rock	1992
Childs Hill	1993
Cant Hook Mountain	*NA*

Humboldt Marten

Federal Status None
State Status Species of Special Concern

Humboldt marten (*Martes americana humboldtensis*) historically occurred from the northwestern coast of the Oregon-California border south to Sonoma County (Grinell and Dixon 1926, as cited in Zielinski et al. 2001) from sea level to about 900 m (3,000 ft) (Grinnell et al. 1937, as cited in Zielinski et al. 2001). Martens, in general, are associated with mature conifer forests (Zielinski et al. 2001). They avoid open areas and are arboreal. Martens prey upon Douglas squirrels, flying squirrels, red-backed voles, and red tree voles. Recently, Humboldt marten were found in adjacent lands close to the southeast border of the property (J. Harris, pers. comm., 2002). Their major predators are great horned owls and coyotes. The subspecies is assumed to be either very rare or extinct.

Pacific Fisher

Federal Status None
State Status Species of Special Concern

Pacific fishers (*Martes pennanti pacifica*) historically occurred in the western states throughout the Rocky Mountains, Cascade and Coast ranges, and Sierra Nevada; however, their current distribution is more fragmented and discontinuous (Zielinski and Kucera 1995). Fishers in northern California are found at elevations ranging from 25 to 1, 000 m (83 to 3,300 ft) (Golightly 1997). Fishers are associated with extensive late-successional forests that have complex structure (Powell and Zielinski 1994, as cited in Cooperrider et al. 2000). Optimal habitat characteristics include multi-storied old-growth with large trees and snags (Schempf and White 1977) in mixed-coniferous forest with at least 50% canopy closure (Zielinski et al. 1997). Breeding and resting activities require large tracts of dense habitat with substantial snags and large logs (Schempf and White 1977).

Fishers have relatively general diets, depending on prey availability and consisting mainly of mammals, including squirrels, skunks, hares, rabbits, porcupines, mountain beavers, gophers, mice, and chipmunks, but also insects and vegetable matter (Grenfell 1979, Golightly 1997, Zielinski et al. 1999). Predation appears to be an important source of mortality. Predators include mountain lions, bobcats, coyotes, and large raptors such as golden eagle, great horned owl, and northern goshawk (Powell and Zielinski 1994, Truex et al. 1998). Fishers appear to outcompete martens in areas where forest species composition has changed from coniferous to mixed forest (Cooperrider et al. 2000), except in areas of deep snow (Krohn et al. 1995, as cited in Cooperrider et al. 2000).

Pacific fishers have been observed twice on the Mill Creek property (Stimson Lumber Company 1998) and have also been detected on private land adjacent to the property. Observations within the Mill Creek area were in high-elevation (1,500 ft), Douglas-fir/hardwood-dominated forests. Suitable movement and dispersal corridors for fishers exist throughout much of the Mill Creek area in the form of riparian corridors and forested saddles between drainages. The existence of snags and abundant downed wood on the property should provide suitable denning and resting sites and foraging habitat. Redwood and montane riparian forest with dense canopy closure may provide suitable resting habitat for fishers. As fishers may forage in a wide range of forest habitats, redwood and montane riparian areas with moderate or dense canopy

The species was found in the following USGS quads (CNDDB 2000):

Crescent City	*NA*
Hiouchi	1972
Sisters Rock	*NA*
Childs Hill	*NA*
Cant Hook Mountain	*NA*

closure should provide suitable foraging habitat.

Additional Species of Interest

Black Bear

Black bears (*Ursus americanus*) occur in both arid and moist forests at elevations from sea level to over 2,000 m (6,560 ft) in North America, although they have been extirpated from some of their former range (Stirling 1993). Along the Pacific coast, they occur primarily in forests dominated by redwood, Sitka spruce, and western hemlock. Within these forest types, early successional areas, including brushy areas, meadows, and riparian areas are often important as foraging habitat (Kronk 2000).

Black bears begin to reproduce at about 4 years. Mating takes place in the summer. After mating, males and females separate. Cubs are born in winter in a maternity den and remain with their mother for about 1½ years.

Black bears are omnivores. Their diet varies depending on the availability of such things as insects, nuts, berries, grasses, roots, tubers, acorns, and other plant material. Black bears may also prey on deer fawns and elk calves, as well as spawning salmon and/or salmon carcasses. On the Mill Creek property, black bears are known to strip redwood bark from young trees to eat the cambium, usually resulting in mortality to the tree.

Roosevelt Elk

Roosevelt elk (*Cervus canadensis roosevelti*) occur along the Pacific coast from Vancouver Island to northern California. Mature bulls live in herds separately from females until early fall, when they join the main herd and rut begins. By mid-October the herds may begin to disperse into smaller groups. Calves are born in spring when food is abundant for cows. A few days after birth, the cows and calves congregate in herds. By late summer, cows, calves, and yearlings congregate into large herds.

Elk graze on grasses, forbs, and other leafy vegetation from late spring to early fall; from late fall to early spring they browse on leaves and branches of shrubs and trees. Ungulates, especially elk, have a substantial impact on plant communities (Houston et al. 2002), including species composition, morphology, and standing crop at all structural layers. Browsing may affect recruitment of understory vegetation as well as overstory canopy.

Elk mortality may occur through hunting, predation, poaching, vehicle impact, and starvation. Predation and disease do not appear to be primary mortality factors. Elk have been observed on the Mill Creek property (K. Stowe, pers. comm., 2002).

APPENDIX D - Results of GIS analyses used to develop recommendations

Table D-1. Landscape-scale erosion risk.

Planning Area	Area (km^2)	SHALSTAB Potential Slope Instability (area, km^2)				Slope Position (area, km^2)				Local Road Density (area, km^2)			Road Length in Watercourse		Composite Landscape Erosion Risk							
		chronic < -10	High -10 to -3.2	Moderate -3.2 to -2.8	Low >-2.8	upper 10%	middle 45%	lower 45% slopes <10%	lower 45% slopes >10%	high 8-12 mi/mi^2	moderate 6-8 mi/mi^2	low 0-5 mi/mi^2	Protection Area (km)		Risk by Area (km^2)[1]				Risk by Road Length (km)			
													inside	outside	very high	high	medium	low	very high	high	medium	low
Rock Creek	30.9	0.2	1.5	3.0	26.2	4.5	12.2	0.3	14.1	4.6	10.5	15.8	43.8	73.1	1.2	10.2	17.0	2.5	11.2	49.1	48.2	8.3
East Fork Mill Creek	20.5	0.1	0.7	1.5	18.1	3.0	8.2	0.3	9.0	3.2	10.4	6.8	37.6	50.5	0.7	7.8	10.7	1.3	6.8	37.7	39.4	4.3
West Branch Mill Creek	19.6	0.1	0.7	1.3	17.6	3.3	7.3	0.7	8.3	5.4	6.6	7.6	34.0	50.5	0.9	7.2	10.1	1.4	9.1	35.2	32.7	7.5
Mainstem Mill Creek	10.8	0.0	0.1	0.3	10.5	1.7	4.1	0.8	4.3	0.9	6.0	4.0	18.2	27.2	0.1	3.4	6.7	0.8	1.6	18.9	22.3	2.6
Bummer Lake Creek	9.5	0.0	0.4	1.2	7.9	1.4	4.0	0.1	4.0	1.6	3.3	4.7	14.8	24.2	0.3	3.2	5.3	0.7	4.5	17.3	15.6	1.4
Wilson Creek	5.3	0.0	0.3	0.6	4.4	1.4	1.9	0.0	2.0	0.5	2.7	2.1	5.1	15.8	0.2	1.6	3.1	0.4	1.3	4.2	13.7	1.8
Terwar Creek	2.6	0.0	0.1	0.2	2.4	0.3	1.2	0.0	1.1	0.3	1.6	0.8	4.3	6.2	0.0	0.9	1.6	0.1	1.3	3.2	5.4	0.7
Jordan Creek	2.2	0.0	0.0	0.0	2.2	0.4	1.1	0.0	0.7	0.0	0.0	2.2	0.8	0.4	0.0	0.1	1.8	0.4	0.0	0.5	0.4	0.0
Hunter Creek	1.1	0.0	0.1	0.2	0.8	0.4	0.5	0.0	0.1	0.0	0.5	0.6	0.4	2.3	0.0	0.2	0.6	0.3	0.1	0.3	1.8	0.4
Smith Plain	0.3	0.0	0.0	0.0	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.7	0.0	0.0	0.2	0.1	0.0	0.0	0.3	0.4
Total	**102.8**	**0.4**	**3.9**	**8.3**	**90.4**	**16.5**	**40.7**	**2.2**	**43.6**	**16.5**	**41.6**	**44.9**	**159**	**250.9**	**3.4**	**34.6**	**57.1**	**8**	**35.9**	**166.4**	**179.8**	**27.4**

1. Classes are based on the composite score from slope stability, basin position, and local road density indicators. Scores do not incorporate road length in watercourse protection areas.
2. Classes are based on the composite score from all indicators. Road lengths are first assigned scores from intersecting 10m-grid cells, and an additional score is added based on proximity to watercourse protection areas.

Table D-2. Road-stream crossing risk.

Planning Area	Area (km^2)	Diversion Potential (# crossings)		Erosion Potential (# crossings)				Potential Erosion Volume (# crossings)				Composite Road-Steam Crossing Risk (# crossings)			
		no	yes	low	moderate	high	very high	0 yd^3	1-100 yd^3	100-700 yd^3	>700 yd^3	low	moderate	high	very high
Rock Creek	30.9	187	49	54	95	50	37	1	38	143	54	1	24	116	66
East Fork Mill Creek	20.5	80	48	48	37	24	19	3	49	72	4	3	23	58	21
West Branch Mill Creek	19.6	74	46	78	17	8	15	3	73	42	2	3	34	66	11
Mainstem Mill Creek	10.8	26	20	19	11	11	5	3	16	23	4	3	8	22	5
Bummer Lake Creek	9.5	56	19	36	22	8	9	0	19	46	10	0	13	37	8
Wilson Creek	5.3	1	0	1	0	0	0	0	1	0	0	0	0	0	0
Terwar Creek	2.6	10	8	7	5	4	2	1	1	14	3	0	7	5	6
Jordan Creek	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hunter Creek	1.1	1	1	0	1	1	0	0	1	1	0	0	1	1	0
Smith Plain	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**102.8**	**435**	**191**	**243**	**188**	**106**	**87**	**11**	**198**	**341**	**77**	**10**	**110**	**305**	**117**

NA= not available

Table D-3. Vegetation management for ecological benefits.

Planning Aread	Area (km^2)	Stand Age and Thinning History (area, km^2)								Quality Habitat buffer (area, km^2)		NSO Activity Buffer (area, km^2)		Connectivity				Composite Priority for Vegetation Management for Ecological Benefits (area, km^2)			
		0-5 y	5-10 y		10-20 y	10-20 y		20-40 y	>40												
			<3 ha	>3 ha	thinned	unthinned <3 ha	unthinned >3 ha			In	Out	In	out	1/4 mile	1/2 mile	3/4 mile	> 3/4 mile	low	medium	high	very high
Rock Creek	30.9	2.3	0.1	4.4	0.1	0.1	4.4	12.0	7.5	17.9	13.0	1.6	29.3	17.8	9.5	2.8	0.8	5.5	9.6	10.3	5.4
East Fork Mill Creek	20.5	0.5	0.0	1.0	0.4	0.0	3.9	11.0	3.7	16.5	4.0	1.5	19.0	16.4	3.3	0.7	0.0	1.1	4.7	11.4	3.3
West Branch Mill Creek	19.6	1.7	0.0	3.2	0.5	0.0	2.3	8.4	3.5	11.5	8.1	0.2	19.4	11.4	6.9	1.3	0.0	3.3	5.7	7.1	3.5
Mainstem Mill Creek	10.8	0.4	0.1	0.6	0.9	0.1	2.6	4.4	1.7	5.7	5.1	0.3	10.5	5.7	3.5	1.7	0.0	1.0	4.1	4.7	1.0
Bummer Lake Creek	9.5	0.4	0.1	1.5	0.2	0.0	2.3	3.4	1.7	3.6	6.0	0.5	9.1	3.6	3.3	2.1	0.6	2.0	2.9	3.5	1.1
Wilson Creek	5.3	0.2	0.0	0.2	0.2	0.0	1.5	2.8	0.3	3.6	1.7	0.0	5.3	3.6	1.7	0.0	0.0	0.3	1.6	2.1	1.3
Terwar Creek	2.6	0.4	0.0	0.6	0.0	0.0	0.3	0.5	0.8	1.7	0.9	0.0	2.6	1.7	0.9	0.0	0.0	0.3	1.1	0.6	0.6
Jordan Creek	2.2	0.0	0.0	0.2	0.0	0.0	0.0	0.4	1.7	1.5	0.7	0.0	2.2	1.5	0.7	0.0	0.0	0.6	1.1	0.3	0.2
Hunter Creek	1.1	0.1	0.0	0.4	0.0	0.0	0.4	0.1	0.1	0.1	1.0	0.1	0.9	0.0	0.5	0.1	0.4	0.3	0.4	0.4	0.0
Smith Plain	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Total	**102.8**	**6**	**0.3**	**12.1**	**2.3**	**0.2**	**17.7**	**43**	**21.3**	**62.4**	**40.5**	**4.2**	**98.6**	**62**	**30.3**	**8.7**	**1.8**	**14.4**	**31.5**	**40.4**	**16.4**

1. Quality habitat includes old-growth stands and scattered old-growth >3 ha.
2. Classes are based on the composite score from stand condition, habitat buffer, NSO activity buffer, and connectivity indicator scores

Table D-4. Vegetation management for fuels and fire hazard reduction

Planning Area	Area (km2)	FRAP Fire Hazard (area, km^2)			Stand Age and Thinning History (area, km2)					Natural Ignition Areas[1] (area in km2)	Composite Priority for Fuels and Fire Hazard Reduction (area, km^2)[2]			
		high	moderate	low	0-10 y	11-20 y unthinned	11-20 y thinned	21-100 y	>100 y		very high	high	moderate	low
Rock Creek	30.9	6.4	11.2	13.2	6.9	4.4	0.1	17.1	2.4	2.7	3.6	4.4	6.6	16.2
East Fork Mill Creek	20.5	3.3	8.0	9.2	1.4	3.9	0.4	14.3	0.5	1.6	3.0	2.9	4.5	10.1
West Branch Mill Creek	19.6	5.1	7.9	6.6	4.9	2.3	0.5	11.8	0.2	2.4	2.4	3.8	5.1	8.3
Mainstem Mill Creek	10.8	2.7	4.1	4.1	1.1	2.7	0.9	5.9	0.2	1.2	2.2	1.8	2.5	4.3
Bummer Lake Creek	9.5	2.6	3.4	3.5	1.9	2.3	0.2	4.2	1.0	1.1	1.7	1.5	1.9	4.4
Wilson Creek	5.3	1.1	1.9	2.2	0.4	1.5	0.2	3.0	0.2	0.9	1.2	1.1	1.0	2.0
Terwar Creek	2.6	0.1	1.6	0.9	1.0	0.3	0.0	1.2	0.1	0.2	0.2	0.3	0.9	1.3
Jordan Creek	2.2	0.3	1.6	0.4	0.2	0.0	0.0	2.0	0.1	0.3	0.0	0.4	0.9	0.9
Hunter Creek	1.1	0.4	0.5	0.1	0.5	0.4	0.0	0.1	0.0	0.4	0.2	0.4	0.3	0.2
Smith Plain	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.1	0.2
Total	**102.8**	**22**	**40.5**	**40.2**	**18.3**	**17.8**	**2.3**	**59.8**	**4.8**	**10.9**	**14.5**	**16.6**	**23.8**	**47.9**

1. Natural ignition areas are those areas prone to lightning strikes and include upper basin positions (upper 10%) that have a high or moderately high FRAP fire hazard ranking.
2. Classes are based on the composite score from FRAP fire hazard, stand condition, and natural ignition indicators, as well as an additional score based on whether the grid cell area is within a fire management buffer adjacent to public use areas, roads.

APPENDIX E – Index of GIS data used to develop recommendations

BASE DATE					
Data layer	**Description**	**Data type**	**File path**	**Modification history**	**Origin**
Fire fuels ranking	CDF-produced ranking of fuels hazard (http://frap.cdf.ca.gov/data/fire_data/fuels/fuelsfr.html) used in vegetation management and fuels reduction analysis	e00 (grid)	\final_data\base_data\fuel_ranking\fuel_ranking.e00	original	California Fire and Resource Assessment Program (http://frap.cdf.ca.gov/index.htm)
Previously developed areas	Mill and picnic site polygons with a 100-m buffer	shape	\final_data\base_data\miscellaneous\facilities\facility_buffer.shp	new	Stillwater Sciences
Potential Fish Barriers	Location of culverts that are barriers to fish migration	shape	\final_data\base_data\miscellaneous\fish_barriers\fish_barrier.shp	new	Stillwater Sciences
Geographic location	location layer of the Mill Creek property with respect to OR and CA	shape	\final_data\base_data\miscellaneous\geographic_location\geo_location.shp	new	Stillwater Sciences
Property boundary	boundary of the Mill Creek Parcel	shape	\final_data\base_data\miscellaneous\property_boundary\boundary.shp	original	Stimson Timber
Road Survey data	Location and attributes of Pacific Watershed Associates road surveys points, including stream crossings and landings.	shape	\final_data\base_data\road_survey\road_survey.shp	original	Pacific Watershed Associates
General roads	road network consisting of main haul roads and trails within and surrounding the parcel extracted from the RNSP road network	shape	\final_data\base_data\roads\general\general_roads.shp	modified	Redwood Nat. and State Parks
Redwood Nat. and State Parks roads	original road and trails from the RNSP	shape	\final_data\base_data\roads\park_roads\park_roads.shp	original	Redwood Nat. and State Parks
Redwood Nat. and State Parks roads, clipped to boundary	original road and trails from the RNSP clipped to the parcel boundaries	shape	\final_data\base_data\roads\park_roads\park_roads_clp.shp	modified	Redwood Nat. and State Parks
Stimson digitized roads	original roads and trails from Stimson (provided by RNSP)	shape	\final_data\base_data\roads\Stimson_roads\stimson_roads.shp	original	Stimson Timber
NSO activity sites	NSO activity sites based on Stimson owl surveys (provided by RNSP)	shape	\final_data\base_data\species\NSO_activity\nso_activity.shp	original	Stimson Timber

BASE DATE					
Data layer	**Description**	**Data type**	**File path**	**Modification history**	**Origin**
Infected Port Orford Cedar	Approximate location of infected Port Orford Cedar stands	shape	\final_data\base_data\vegetation\port_orford_root\poc_rot.shp	new	Stillwater Sciences
Vegetation	Vegetation polygons from Stimson (provided by RNSP) modified for age in 2002 based on cut date	shape	\final_data\base_data\vegetation\veg\veg.shp	modified	Stimson Timber
Blueline hydrography	California Watershed Assessment Program 1:24000 hydrographgy based on USGS data	shape	\final_data\base_data\water\bluelines\bluelines.shp	original	California Fire and Resource Assessment Program (http://frap.cdf.ca.gov/index.htm)
DTM streams	stream networked derived from 10-m DTM based on a minimum catchment of 0.04 square km	shape	\final_data\base_data\water\dem_streams\dem_streams.shp	new	Stillwater Sciences
Extended bluelines	DTM stream reaches merged with existing blueline network	shape	\final_data\base_data\water\extended_bluelines\extend_blue_lines.shp	new	Stillwater Sciences
Modified CalWater planning areas	Calwater watersheds (1:24000) clipped to an extent slightly greater than the Mill Creek Parcel	shape	\final_data\base_data\water\planning_area\planning_area.shp	modified	California Fire and Resource Assessment Program (http://frap.cdf.ca.gov/index.htm)
Streams delineated by Stimson	Stimson stream layer which include stream class designation (provided by RNSP)	shape	\final_data\base_data\water\stimson_streams\stimson_streams.shp	original	Stimson Timber
Pre-commercially thinned stands as of 2000	Approxiate boundarys of precommercially thinned stands as of 2000	shape	C:\final_data\base_data\vegetation\pre-com_thin\pct_current	modified	Stimson Timber

ANALYSIS DATA					
Data layer	**Description**	**Data type**	**File path**	**Modification history**	**Origin**
Fire Management Prioritization	Composite score of priority for management for fuels and fire hazard based on stand age, thinning history, ignition potential, and CDF fuels ranking	e00 (grid)	\final_data\analysis_results\eco_benefits\fire_manage\fire_manage.e00	new	Stillwater Sciences
Habitat Connectivity	Habitat connectivity scores	e00 (grid)	\final_data\analysis_results\eco_benefits\habitat \hab_connect \hab_connect.e00	new	Stillwater Sciences
NSO and MAMU quality habitat	Areas designated as quality habitat based on stand age and size	shape	\final_data\analysis_results\eco_benefits\habitat \quality_habitat \quality_hab.shp	new	Stillwater Sciences
Natural ignition source scores	Scores for potential sources of natural igntion based on exposure and fuel ranking	e00 (grid)	\final_data\analysis_results\eco_benefits\natural_ignition \nat_ignite.e00	new	Stillwater Sciences
Stand condition	Stand condition scores	e00 (grid)	\final_data\analysis_results\eco_benefits\stand_cond\stand_cond.e00	new	Stillwater Sciences
Stand condition for Fire Hazard	scores for stand condition based on age class and thinning history	e00 (grid)	\final_data\analysis_results\eco_benefits\stand_cond\stand_fire_haz.e00	new	Stillwater Sciences
Vegetation management for eco-benefits	Composite score for vegetation management for ecological benefits	e00 (grid)	\final_data\analysis_results\eco_benefits\veg_eco\veg_eco.e00	new	Stillwater Sciences
Log Landings	Location of landing surveys	shape	\final_data\analysis_results\landings\landings.shp	modified	Pacific Watershed Associates
Landscape-Scale Erosion Risk	export Arcinfo grid of composite scores for the terrain of the parcel from the landscape-scale erosion risk analysis	e00 (grid)	\final_data\analysis_results\landscape_scale\landscape_risk \terrain_haz.e00	new	Stillwater Sciences
Road erosion risk	Composite score of predicted erosion risk by road length extracted from terrain risk model, developed from the RNSP roads layer	shape	\final_data\analysis_results\landscape_scale\road_risk \road_haz.shp	new	Stillwater Sciences
Shalstab Loq Q/T	Output of the SHALSTAB processing on the 10-m DTM	e00 (grid)	\final_data\analysis_results\landscape_scale\shalstab\shalstab_log_qt.e00	new	Stillwater Sciences
Slope Position Hazard	slope positions rankings used to evaluate erosion hazards for roads (derived from DTM).	e00 (grid)	\final_data\analysis_results\landscape_scale\slope_position \slope_position.e00	new	Stillwater Sciences
Road-stream crossings on roads recommended for closure	Stream crossings used to recommend roads for closure/treatment due to density and potential erosion volumes	shape	\final_data\analysis_results\road_crossings\xing_rec_closed\xing_closed.shp	modified	Pacific Watershed Associates

ANALYSIS DATA					
Data layer	**Description**	**Data type**	**File path**	**Modification history**	**Origin**
Road-stream crossing risk	PWA stream crossings assigned prioritization ranking based on composite scores	shape	\final_data\analysis_results\road_crossings\xing_risk.shp	modified	Pacific Watershed Associates
Roads recommended for closure	Roads recommended for closure/treatment based on density of high risk roads and crossings	shape	\final_data\analysis_results\roads\rec_closed\rec_closed.shp	new	Stillwater Sciences
Road Density	Road density developed using a moving window with an area of 1 square mile	e00 (grid)	\final_data\analysis_results\roads\road_density\road_density.e00	new	Stillwater Sciences

Appendix F - Comments Received on the September 2002 IMR Document

This appendix contains two sections. First, comments received at a September 12, 2002 Community Meeting at which staff from Stillwater Science presented the interim management recommendations. Second, written comments received following the community meeting.

CREEK INTERIM MANAGEMENT RECOMMENDATIONS
COMMENTS RECORDED AT THE THIRD PUBLIC MEETING 9/12/02
CRESCENT CITY, CA

Comments on Forest Restoration

- Consider implementing both pre-commercial and commercial thinning on the property to secure restoration benefits.
- Consider thinning at later stages of stand growth for continued forest restoration.
- Consider use of horse logging for low-impact method of thinning. It has been used as in Redwood National Park (i.e. in vicinity of Little Bald Hills Road)
- Consider utilizing ecological thinning to generate income for restoration and management

Comments on other plan elements

- Some of recommendations/comments on drafts were apparently not addressed in final document.
- Mitigations are absent from plan if recommendations don't work, and some recommendations are controversial.
- Consider addressing high erosion risk areas in the short-term regardless of expected future use or value

Comments on Funding and Implementation

- Consider funding mechanisms based on what must be done to protect and restore resources
- Consider adding a fiscal element to the Management Recommendations.
- Consider establishing a mechanism to receive and utilize donated resources
- Consider lobbying state legislature as a group to obtain funds for Mill Creek possibly tied to future bond acts
- Consider balancing preservation with other management alternatives, i.e. sustainable forestry activities that would generate revenue for property management.

- Consider including the Mill Creek property under the MOU for Redwood National and State Parks in order to access federal money possible under a different MOU and planning configurations.

- Consider establishment of an "adopt-a-park movement" to secure volunteer engagement and support for Mill Creek and other parks.

- Consider allowing organized public access to groups other than public schools prior to public opening

Comments on Advisory Committee

- Consider including information on the Mill Creek Advisory Committee

- Consider inviting Del Norte County to join the advisory committee

- Consider developing a mechanism to have the public participate in the Advisory Committee

- Advisory Committee should balance commitment to resource protection with public access and appropriate use

- Consider including technical expertise on the Advisory Committee in addition to representatives of the funding agencies.

SMITH
RIVER
ALLIANCE
P.O. Box 2129, Crescent City, CA 95531

October 10, 2002

Ruskin Hartley
Save-the-Redwoods League
114 Sansome Street, Rm. 1200
San Francisco, CA 94104

SUBJECT: MILL CREEK INTERIM MANAGEMENT RECOMMENDATIONS

Dear Ruskin:

The Interim Management Recommendations (IRM) appropriately highlight the opportunities and challenges associated with management of the Mill Creek property. The Smith River Alliance (SRA) and Cal Trout look forward to continued work with Save-the-Redwoods League, California Department of Parks and Recreation (DPR), Del Norte County, and other partner organizations/agencies to implement priority recommendations for Road Management; Vegetation Management; Aquatic and Terrestrial Habitat Protection and Enhancement; and Public Access and Use. Toward that end, SRA and Cal Trout offer the following comments.

Updates and Engagement Re Priority Action

There are a number of priority areas and actions identified in the IRM --- from high risk road-stream crossings --- to areas where young stands within fire buffer areas are in immediate need of thinning. It would be useful if the IMR and/or DPR could outline a target performance schedule, budget, and how the community and partner organizations will be kept informed and engaged regarding these high priority recommendations and tasks.

Funding and Alternative Approaches for Priority Actions and Tasks

We believe it will be important to develop estimated costs/budgets and alternative approaches for making progress on priority actions and tasks identified in the IMR. The development of these estimates and the engagement of partner and community interests has the potential to support/enable cooperative ("joint problem-solvers") behaviors that will be beneficial for the Mill Creek property and the region.

The Value of Pilot Projects

We are also interested in working with potential partner entities to identify interim and pilot projects that would be consistent with the IMR. Our real interest here is that we continue the dialogue and cooperation around the issues of interim management with appropriate and timed actions and pilot projects. For example, there are a number of pilot and interim projects that are underway at this time --- such as studies and monitoring regarding salmonid populations, and special visitation and use for Del Norte County Unified School District for environmental education purposes.

We support continued collaboration among partner entities to expand the development and funding of interim/pilot projects consistent with the IMR. We will contact DPR regarding how SRA and Cal Trout can continue to support and participate in this work.

Thank you for your focus on these issues over the last several months. Regarding responses to this letter and correspondence concerning the IMR, please copy Tom Weseloh, Northwest Coast Manager for California Trout.

Sincerely yours,

Grant D. Werschkull, Executive Director

c: Chuck Blackburn, Del Norte County Board of Supervisors
Michael Bowen, California Coastal Conservancy

Ruskin Hartley

From: eileen cooper [------]
Sent: Friday, October 11, 2002 12:54 PM
To: rhartley@savetheredwoods.org
Subject: Re: Mill Creek Management Recommendations - Community Meeting SEPT 12

Friends of Del Norte

A nonprofit membership based conservation group

advocating sound environmental policies for our region

P.O. Box 229, Gasquet CA 95543, 707-951-3020

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Final Comments

Comments for Mill Creek Interim Management Plan: Thursday Sept. 19, 2002

Overall, the Mill Creek Property Interim Management Plan is excellent. The Redwood State Park area, the Redwood National Park and the Mill Creek Property are of state, national and international significance. The acquisition was financed by the taxpayers of all of California and the contributions of individuals from all over. The redwoods are designated as a world heritage site. Thus, this acquisition must be managed consistent with the state, national, and international significance it has, rather than something of primarily local interest. Because of Mill Creek's importance as a refugia for salmon, we hope that adequate funding is obtained to enable effective implementation of the management plan. We hope that the problematic sedimentation risks are attended to as soon as possible.

The enhanced redwood park area can be a significant attraction to bring in tourists from all over the world, thus providing a substantial boost to our local tourist service businesses and to the local economy. We hope that the immediate goals can be achieved soon, so that the public can enjoy the park. Following are concerns with interim management plan:

* Need provision for adequate interim security and protection of the property to prevent unauthorized entry and activity such as hunting, bootleg logging, and off road vehicle use.

* Road management -- As indicated, roads that are not part of the identified primary road network that are high erosion risk should have erosion control measures applied without regard to maintaining the road for vehicular traffic, as it is likely that many of these roads will ultimately be decommissioned.

* Looking ahead-- Decommissioned roads and secondary roads are indicated as potential trails for non-motorized use. The actual amount of trails should not fragment the landscape. The current number of secondary roads is prolific and does fragment and disrupt landscape and wildlife. To enhance the natural experience and minimize disruption of the natural environment, the majority of secondary and decommissioned roads should simply be returned to as natural a state as feasible within available funding, preserving generous undisrupted corridors for wildlife. With the exception of Prairie Creek, there is nowhere else in the Redwood Park where people are clear that they are really **in** the park, and where they can get away from road noise.

Thank you,

Eileen Cooper, Conservation Chair, Friends of Del Norte.