

AFFECTED ENVIRONMENT



INTRODUCTION

The emphasis in this chapter is on a description of features that would or could be impacted by the alternatives. However, there is discussion of some attributes that provide context, such as

climate; other topics are discussed because they could affect development called for by the alternatives, such as earthquakes, tsunamis, and floods.



NATURAL RESOURCES

CLIMATE

The Pacific Ocean is a moderating influence on the climate of the parks. The parks have wet, mild winters and relatively dry summers with frequent coastal fog. Most rain falls between November and March, although it can rain any time. Annual rainfall averages 70 inches but can vary erratically between locations. Inland areas along the Smith River may have more than 100 inches of annual precipitation. Winter storms from the Pacific Ocean bring intense rainfall over several hours or days, particularly warmer storms from lower latitudes. These storms may cause both small streams and larger rivers to flood. Snow is infrequent and usually does not last long even at higher elevations inland.

Temperatures vary only slightly from summer to winter along the coast. Inland areas such as Jedediah Smith Redwoods State Park and the Redwood Creek basin have a greater fluctuation in temperatures. Mean temperatures at Prairie Creek Redwoods State Park are 47°F in January and 59°F in June. Temperatures above 90°F or below freezing are rare.

Winds come from the northwest or southwest and are generally light. Intense winter storms may be accompanied by damaging winds. Occasionally in the fall, a warm dry wind from the east produces a rapid drying effect, intensifying the fire hazard in the normally moist redwood forests.

Fog is a dominant climatic feature, generally occurring daily in the summer and not infrequently during the rest of the year. Fog occurs mostly within a few miles of the coast. Fog may extend inland as far as Hiouchi. The Bald Hills and the Little Bald Hills are generally free of fog because of their elevation and distance from the coast.

AIR QUALITY

Redwood National Park has been designated as a class I airshed pursuant to Part C of the Clean

Air Act, as amended (42 U.S.C. 7401 et al.). State park lands within Redwood National and State Parks are classified as class II airsheds, with some areas being considered for reclassification to class I. Class I and class II designations are given to areas where air quality is cleaner than the national ambient air quality standards. Class I areas have the most stringent regulations for the protection of air quality, permitting the lowest increments of air quality degradation, whereas class II status allows moderate deterioration that might accompany well-planned growth.

The parks have been assigned to the North Coast Air Basin by the California Air Resources Board, which is under the jurisdiction of the North Coast Unified Air Quality Management District. A particle monitor in the parks measures fine particle mass (matter less than 2.5 micrometers in diameter), sulfates, nitrates, and aerosol elemental composition. An ozone and meteorological monitoring site operated in the parks between 1987 and 1995. Other monitoring stations are in Crescent City and Eureka.

Air quality in Redwood National and State Parks is considered good to excellent because of the low population, scarcity of pollutant sources, and prevailing westerly ocean winds. All federal standards are consistently achieved, including those for ozone, carbon monoxide, particulate matter, nitrogen dioxide, sulfur dioxide, and lead. The most significant air pollutant in the parks is PM_{10} (particulate matter less than 10 micrometers in diameter), which is primarily from widespread nonindustrial burning and the industrial burning of timber harvest slash piles. In the past, total suspended particulates exceeded air quality standards, but improved technology, better use of materials, and fewer sawmills (and especially their tepee burners) in the region have resulted in a reduction in suspended particulates. Two industrial sites along Humboldt Bay (50 miles south of the park) are the most serious point sources of pollution. Local views and scenes are often impaired by fog, rain, low clouds, salt spray haze, and natural forest haze inversion.

SOILS AND GEOLOGY

Geology

Northern California is tectonically very active, and its complex geology and topography are controlled by movement along faults and crustal plates. The topography of the parks is influenced by several north-northwest trending faults. They range from low-angle thrusts to vertical faults and in most areas form the boundaries between major lithologic units in the parks. Two important faults cut through Prairie Creek Redwoods State Park — the Lost Man and Grogan Faults. The Grogan Fault, a well-defined north-northwest lineament that also bisects the Redwood Creek basin, has brought two distinctive rock types into contact with each other. Other faults that are perpendicular to the primary north-northwest fault orientation create the trellis-like drainage found in the parks (D. Short, RNSP geologist, pers. comm., 1997). Late Cenozoic uplift and stream erosion are particularly evident in the steep inner gorges of Redwood Creek basin (NPS 1996).

Mesozoic-age (Jurassic to Cretaceous) rocks of the Franciscan complex underlie most areas of Redwood National and State Parks. The Franciscan complex is bounded on the west by the Cascadia subduction zone and on the east by the South Fork Mountain fault (or Coast Range thrust). The Franciscan complex was laid down on the ocean floor as deposits of sand and mud about 150 to 100 million years ago. These deposits were carried eastward on the oceanic plate, accreted to the North American continent, and eventually uplifted to form the Coast Range (for more information on plate tectonics see the discussion of earthquakes and tsunamis under the "Public Safety" section of the "Affected Environment"). Through time, folding and faulting further complicated the Franciscan complex rocks. Bedrock beneath the parks is mostly composed of sedimentary graywacke sandstone, mudstone, metamorphic schist, and minor amounts of conglomerates and melange. Other deposits include Tertiary marine deposits and serpentinites in the Little Bald Hills area just east of Crescent City. Pliocene/Pleistocene

cobbles, sands, and silts of the Prairie Creek formation are thought to have been deposited in a river delta laid down by the Klamath River more than two million years ago. Quaternary alluvial and marine deposits blanket the stream valleys and coastal areas of the parks.

Soils

Soil development occurs in response to the weathering of the parent materials (rocks and alluvial deposits) and input from surface materials (vegetation), and varies depending on the topography (slope, aspect, and hydrologic features), underlying rock composition, and time. For the most part, the soils in the parks are well developed because the mild wet climate has caused a high degree of weathering of the underlying materials. Most of the soils have strongly developed surface horizons that are rich in organic matter and nutrients, particularly in areas that (1) have coniferous forests, oak woodlands, and prairies, (2) are moderately coarse textured, and (3) have infiltration capacities but possess little cohesion and very low shear strength. The steep terrain, rainy climate, and deep, medium-textured soils make the area very susceptible to erosion.

The soils in the parks have developed primarily from rocks of the Franciscan complex. Underlying geologic units strongly influence the nature of the soils, depending on their mineralogical and chemical composition and susceptibility to weathering and erosion. Residual soils are found in isolated areas on sloping ridge crests, and alluvial soils have formed in alluvial valleys, on floodplains, and on stream terraces.

Descriptions of the soils are derived from detailed soil/vegetation maps. Upland soils were mapped on a quad-by-quad basis in the Humboldt-Del Norte Counties, California, soil vegetation surveys (Alexander et al 1952-78), and agricultural lands (valley bottoms) were delineated by staff at the University of California at Davis (McLaughlin et al 1965). The soils in Redwood Creek basin have been further classified by NPS staff, and these data are by far the

most complete and detailed soils information in the parks.

Certain soil properties and other local conditions may restrict land uses. Shallow soils, fine or skeletal textures (more than 35% rock fragments that are larger than 2 millimeters), steep slopes erodible due to clays or weak underlying materials, and too little or too much drainage can make some areas inappropriate for certain land uses. These characteristics would be considered when planning development projects in the parks, and facilities would not be sited in any areas that contain highly erodible soils.

Erosion

Certain rivers in northwestern California, such as Redwood Creek and the Mad, Eel, and Mattole Rivers have naturally high sediment yields because of recent tectonic activity (uplift of the mountains), relatively weak geologic materials, steep slopes, and high precipitation rates. These conditions combined with land use activities such as timber harvesting, road construction, and ranching give the region one of the highest denudation rates in the United States (Jones and Stokes 1981). The rate of erosion for the north coast region ranges from 6.4 to 16 tons per acre per year, 10–100 times the rate for other river basins in the country (CDPR 1982 & 1983).

Many areas of the parks are susceptible to mass wasting — such as debris slides and avalanches, block falls, shallow and deep-seated landslides, streamside landslides, and earthflows. During periods of high precipitation, slope failures commonly occur in watersheds impacted by logging activities, in areas along Highway 101 near Del Norte Coast Redwoods State Park and the Prairie Creek bypass, and along steep terrain throughout the parks. The parks' policies are to allow natural erosion processes to continue, but where these processes have been accelerated by human activities such as logging, measures would be undertaken to limit damage to RNSP resources.

The coastline of the parks is subject to direct waves, high tides, storm waves and surges, tsunamis, sea cliff retreat, landslides, block falls, and surface erosion. Fluctuations in ocean levels and climate, tectonic activity, composition of the underlying bedrock, and land uses are factors that influence the rates and types of erosion along the coast. Landslides and slumping of the unstable Franciscan complex and other coastal deposits have caused road damage during the rainy season from November to March. In low-lying areas along the coast, such as Freshwater Lagoon, the natural coastal processes and near-shore marine ecosystems have been altered by the presence of Highway 101.

Redwood Creek Basin — Past Logging Activities and Watershed Restoration

In 1978, 48,000 acres were added to Redwood National Park

to protect existing irreplaceable Redwood National Park resources from damaging up slope and upstream land uses, to provide a land base sufficient to insure preservation of significant examples of the coastal redwood in accordance with the original intent of Congress, and to establish a more meaningful Redwood National Park for the use and enjoyment of visitors. . . . The Secretary . . . is further authorized . . . to initiate . . . a program for the rehabilitation of areas within and upstream from the park contributing significant sedimentation because of past logging disturbances and road conditions, and, to the extent feasible, to reduce risk of damage to stream side areas adjacent to Redwood Creek and for other reasons.

(Public Law 95-250, March 27, 1978)

Public Law 95-250 authorized Congress to appropriate up to \$33 million to carry out the rehabilitation provisions of the act; to date, about \$13 million has been appropriated for these restoration efforts. Before watershed restoration activities began, timber had been harvested from

more than 62% of the watershed upstream of the confluence of Prairie Creek with Redwood Creek and the area was traversed by about 1,110 miles of logging and ranch roads and 5,400 miles of skid roads. The park expansion lands included about 415 miles of logging roads and more than 3,000 miles of skid roads (*Redwood Creek Watershed Analysis*, in press). (There were then about 2,400 miles of skid roads and about 695 miles of logging roads in the park protection zone.)

Public Law 95-250, the expansion legislation, also established a park protection zone covering 33,000 acres of private timberlands immediately upstream from the national park in the Redwood Creek watershed. In conjunction with California's timber harvest plan process, RNSP resource staff review proposed timber harvest activities in this zone and throughout the Redwood Creek basin. Other efforts to protect downstream park resources from upstream land use include reviewing newly proposed timber harvest regulations, monitoring sediment movement and implementing erosion prevention work, and road decommissioning on private lands in the Redwood Creek basin. In 1995 a framework for implementing cooperative erosion prevention work on private lands upstream from the parks was established through a memorandum of understanding among Redwood National and State Parks, other government agencies, and private landowners in the Redwood Creek basin. Although the national park is authorized to fund upper basin restoration work with NPS funds, most projects to date have been funded primarily by limited outside sources.

The greatest human-induced threat to downstream aquatic and riparian resources in and along the main channel of Redwood Creek are the roads upstream of the national park. Currently, there are about 1,110 miles of logging roads upstream from the park boundary in Redwood Creek basin, and nearly half of these roads have not been maintained. These roads were originally built to less than current standards, crossing steep slopes on unstable soils that are prone to landslide and fluvial erosion. The potential for stream diversions at stream crossings is common. Large-scale fluvial erosion resulting from

diversions of streams at road crossings can account for 30% to more than 60% of the erosion occurring within a watershed (D. Short, RNSP geologist, pers. comm., 1997; USGS 1995; Hagans et al. 1987).

In 1978 a watershed rehabilitation program was initiated in Redwood National Park that concentrates on preventing human-induced erosion and encourages the return of natural vegetation patterns in the watersheds. The program has emphasized erosion prevention by restoring natural runoff patterns through removing road fill from stream and water flow courses. RNSP staff are currently using a watershed-by-watershed approach that will prioritize and restore the areas that pose the greatest erosional threats first. When the watershed restoration program began in Redwood Creek basin, there were 415 miles of logging and ranching roads within the legislated national park boundary. To date, about 190 miles of these roads have been treated to reduce road-related erosion and assist in overall ecosystem recovery, and now there are 225 miles of roads remaining. About 155 miles of the remaining logging roads within the park in the lower basin (with 831 fluvial sites and 376 culverts) are scheduled for treatment to reduce erosion potential. Seventy miles of logging roads are not scheduled for removal at this time because they are necessary for public and administrative access. Ultimately, the Redwood Creek ecosystem within the national park should be restored to conditions similar to what would have existed without human disturbances.

The first *Watershed Rehabilitation Plan* was written by NPS staff in 1981. Over the years, careful monitoring of the results and costs has improved the success of the restoration treatments, and the plan is currently being updated to reflect these cost savings and improved technology. In addition, the updated plan incorporates a reranking of the priorities of work based on current road conditions and existing threats to sensitive natural resources.

In areas in the Redwood Creek basin that are subject to intensive timber harvest, road networks are the primary cause of accelerated mass wasting, while surface erosion is a minor

contributor. Studies show that about 40% of the total sediment yield to Redwood Creek is directly from the erosion of roads and logging landings (M. A. Madej, pers. comm., 3/29/99). Another 46% of the sediment yield is from mass movement, both natural and road induced. About 14% of the sediment yield to Redwood Creek originates from streambank erosion. Streambank erosion can also be both natural and a result of road erosion upstream. During the period between 1980 to 1990, roughly 72% of the bedload portion (sand and gravel) of the total sediment load transported by Redwood Creek originated from areas upstream of the park (Madej 1992). Park hillslopes during that period contributed only 7% of the bedload, while the remainder of the bedload resulted from sediment that had previously been deposited in stream channels.

Logging roads cut into the hillslopes alter the natural hydrology, concentrate water on the surface, accelerate erosion, and in many cases result in slope failure. During intense storms and as roads age, their potential for catastrophic failure increases due to the plugging and rusting of culverts, the decay of buried organic debris, and the plugging and diversion of groundwater and streamflow. These failures add tremendous quantities of sediment to the streams in the watershed and have cumulative downstream impacts that affect terrestrial, riparian, and aquatic communities. Materials eroded from hillsides can overwhelm the transport capacities of the streams, causing aggradation (accumulation of sediment in and along the streams), channel widening, and the loss of streamside vegetation. The influx of sediment has also deteriorated water quality (raised water temperatures, lowered dissolved oxygen, and increased turbidity) and decreased the quality and quantity of fish spawning habitat in Redwood Creek and its tributaries.

Some road segments, although revegetated and displaying no signs of instability, still pose a serious erosion threat if they fail and contribute sediment to stream channels. Above average rainfall during fall 1996 and large storms in December 1996 and January 1997 saturated soils along the coast of northern California. Roads

within and upstream of the parks, particularly in the Redwood Creek basin, sustained severe damage. Much of this damage occurred from large landslides initiated by saturated fills along abandoned logging roads. Redwood National and State Parks have received supplemental appropriations to treat the extensive damage caused by these storms inside the parks. These treatments vary from road repairs to watershed restoration.

Other Watershed Disturbances

Timber harvesting in the watersheds upstream of the parks has the potential to adversely affect numerous RNSP values. Besides the increased potential for erosion through road building and the use of heavy equipment during harvests, harvesting within riparian areas removes the vegetative cover that maintains optimum stream temperatures and greatly reduces the supply of large woody debris necessary for fish habitat and regulating sediment movement throughout the aquatic system. Also, clear cuts directly adjacent to forested land in the parks create microclimatic changes that can penetrate more than 300 feet into the adjacent parklands.

Specific areas of concern in the state parks include the entire basin of Mill Creek upstream of Jedediah Smith Redwoods State Park, the upper West Branch of Mill Creek in Del Norte Coast Redwoods State Park, and those portions of the Prairie Creek watershed containing the headwaters of the east side tributaries in Prairie Creek Redwoods State Park.

In areas where harvests are proposed that may affect RNSP resources, the state parks are authorized under the California *Forest Practice Rules* to become a member of the state's interdisciplinary review team. Team members ensure that harvest plans conform to the rules and the state's environmental laws. Also, timber harvest plans must designate any harvest areas within 200 feet of RNSP lands as a special treatment area. Within these areas silvicultural methods must be proposed that are compatible with the purposes of the parks.

PAST ROAD RESTORATION PROJECT SITES



BEFORE
C-30 Road, Emerald Creek
1982 — beginning excavation
of steep inner gorge road fill.

DURING
C-30 Road, Emerald Creek
Winter 1982 —
after excavation of steep
inner gorge.



AFTER
C-30 Road, Emerald Creek
1988 — restored inner gorge
with vegetation regrowth.

PAST ROAD RESTORATION PROJECTS



BEFORE

Ah Pah Road

Before restoration, road crosses hillside.



AFTER

Ah Pah Road

One year after restoration, hillside reshaped similar to preroad configuration with reestablished native vegetation.



BEFORE

W-Line, Dolason Creek

1980 Before restoration, road crosses hillside.



AFTER

W-Line, Dolason Creek

1982 Two years after restoration, hillside reshaped similar to preroad configuration and native vegetation reestablished. A backcountry trail now follows the approximate route of the recontoured road.

The legislation that added 48,000 acres to the national park also established a park protection zone covering 33,000 acres on private timber lands in the upstream portion of the Redwood Creek basin. There are about 250 to 350 miles of logging roads in this area, and inventories show that nearly half of these roads present a significant source of sediment to downstream areas of Redwood Creek. NPS staff work with private interests in this zone to limit the effects of logging and other land use practices. Besides reviewing timber harvest plans and regulations, staff monitor sediment movement, and occasionally remove or repair roads in conjunction with cooperating landowners.

Construction of logging roads or reconstruction of existing roads will continue to occur upstream of the national park including areas in the park protection zone. Maintenance of these roads is governed by the *California Forest Practice Rules* and is required for one year after harvest. If the road is designated as a temporary road, stream crossings must be removed, while a permanent designation requires that stream crossings must pass a 50-year return interval storm. Culverts on permanent roads that are not maintained after the required three-year period would, over time, become plugged, develop holes, fail, and cause damage to downstream resources.

RNSP staff also monitors continuing road failures along the Highway 101 Bypass around Prairie Creek Redwoods State Park and reviews repair work undertaken by the California Department of Transportation (Caltrans). Construction of the bypass resulted in a large influx of fine-grained sediments into pristine streams in the state park during an October 1989 storm.

Sediment catchment basins have been constructed along the Highway 101 bypass to collect sediment and runoff from slopes cut into the hillside. Containment tanks were placed adjacent to emergency truck escape ramps to collect runoff or spilled materials, such as petroleum products or materials being hauled, and to prevent contamination of downstream RNSP resources. Caltrans maintains the basins and tanks under conditions established by the National Park Service, the California Regional

Water Quality Board, and the California Department of Fish and Game to protect downstream aquatic resources and sites.

WATER RESOURCES

Surface Water

Surface water resources in Redwood National and State Parks consist of saltwater (Pacific Ocean), freshwater (streams and rivers), and transitional areas (estuaries and lagoons).

There are about 35 miles of shoreline within the parks. The western boundary of the national park extends 0.25 mile beyond the mean high tide line. These offshore lands are held in title by the State Lands Commission with the exception of lands in the northern end of the parks that are held by the Crescent City Harbor District. NPS jurisdiction applies to the area 0.25 mile offshore within the legislated boundary of the park. The coastal jurisdiction of state park lands extends to 1,000 feet west of the ordinary high-water mark.

Three large river systems drain most of the parklands in many areas and have cut deep gorges through forested mountainous terrain. Redwood Creek has a total drainage area of 278 square miles and drains into the southern portion of the national park; one-third of this area is within Redwood National Park. Redwood Creek flows northwestward, follows the Grogan Fault for most of its length, and has many steep, short tributaries that drain relatively small areas of the watershed. Incised inner valleys in Redwood Creek basin are highly susceptible to mass wasting by shallow debris slides and debris avalanches, especially in areas traversed by abandoned logging roads (for more information see the "Past Logging Activities and Watershed Restoration" section). Natural surface runoff patterns are altered by roads, which causes accelerated natural surface erosion and mass wasting.

The Klamath River, the largest river in the north coast area (drainage area of 15,000 square miles in California and Oregon) flows through a narrow strip of parkland in the central portion of

the parks. The Smith River flows through the northern part of the parks (Jedediah Smith Redwoods State Park) and drains 614 square miles in the Smith River drainage basin of Oregon and California that are very steep and prone to landslides. Many other small tributary streams are also included within the parks' boundaries.

Annual stream flows in the parks are highly variable due to seasonal precipitation in the region. The rainy season typically extends from October through April, but most of the precipitation and subsequent high flows occur between November and March, with less precipitation and corresponding low flows during the summer and fall. The Smith and Klamath Rivers drain large mountainous areas and are influenced by snowmelt. Snowmelt has only a minor impact upon the total runoff entering Redwood Creek. However, a few large floods, including that of December 1964 that caused the highest recorded peak flow on Redwood Creek, have been augmented by rapid snowmelt induced by warm rain (USGS 1975). Average annual discharge, peak, minimum, and average recorded flows for the major streams are presented in table 11.

There are no natural ponds or lakes within the parks, although lagoons, sloughs, and marshes occur as a result of oceanic and tectonic processes. The western half of the waters and shoreline of Freshwater Lagoon, southwest of Orick, are in Redwood National and State Parks; this is the only large lagoon in the parks. Espa Lagoon is a small, natural wetland at Gold Bluffs Beach. Two sloughs in the lower Redwood Creek valley are considered part of Redwood Creek estuary. There are several ponds adjacent to former mill sites in the parks — one on Richardson Creek (Marshall Pond) and one on Lagoon Creek.

Several stock and fire suppression ponds and sediment catchment basins along the Highway 101 bypass are also considered artificial impoundments.

In 1974 the State Water Quality Control Board designated all offshore waters between Cushing Creek and the south end of Freshwater Lagoon (approximately 31 miles) as an area of special biological significance (ASBS), one of 34 statewide. (This designation is one of 12 types of California Marine Protected Area Designations.) Designated as the Redwood National Park area

TABLE 11: FLOW STATISTICS AND BASIN AREAS FOR THE MAJOR STREAMS IN THE PARKS

STREAM	AVERAGE ANNUAL DISCHARGE acre-feet/year	AVERAGE FLOW cubic feet/second	PEAK FLOW cubic feet/second	MINIMUM FLOW cubic feet/second	BASIN DRAINAGE AREA square miles
Smith River at Crescent City ^a	2,721,000	3,772	228,000 Dec. 22, 1964	160 Oct. 24, 1964	614
Klamath River at Klamath Glen ^b	12,600,000	17,461	557,000 Dec. 23, 1964	1,310 Sept. 4, 1977	15,000
Redwood Creek at Orick ^c	734,700	1,019	50,500 Dec 22, 1964	2.1 Oct. 20, 1987	278

Source: NPS 1985, USGS 1997

a. Smith River period of record is 1932-96, gaging station 11532500.

b. Klamath River period of record is 1963-94, gaging station 11530500.

c. Redwood Creek data period of record is 1954-96, gaging station 11482500.

of biological significance, it overlaps with the boundaries of Redwood National and State Parks. The ASBS concept recognizes that certain biological communities, because of their value or fragility, deserve very special protection, consisting of preservation and maintenance of natural water quality conditions to the extent practicable ("Water Resources Control Board and California Regional Water Quality Control Board Administrative Procedures," September 24, 1970, section XI and miscellaneous rev. 7-9/1/72). The California Department of Fish and Game is responsible for managing the marine resources in the area of special biological significance.

The general regulations that accompany the ASBS designation do not include recreational or commercial fishing or collection of invertebrates. *These regulations* are generally targeted at protecting offshore water quality from point and nonpoint sources of pollution, but *they* are not applicable to vessel wastes or the control of dredging and dredged spoils. However, state regulations that apply to state and national parks prohibit kelp collection and offer some other limited protection.

An inventory of intertidal areas within the parks from Redwood Creek to Pt. St. George was completed in 1977 (Boyd and DeMartini). Dominant plant and animal species were identified at six representative monitoring sites.

Groundwater

Groundwater aquifers are few in number and small in supply in the parks because most of the area is mountainous and is underlain by bedrock — conditions that do not provide for groundwater storage. Four groundwater basins, primarily near the mouths of the major rivers, have been identified by the California Department of Water Resources — including the Smith River plain, the lower Klamath River valley, the Prairie Creek area, and the Redwood Creek valley. The best aquifers occur in alluvium, terrace sediments, and dune areas of the parks. Additional small unnamed aquifers, such as the aquifer that supplies water to the Jedediah Smith area, are

located throughout the parks, and water supplies are dependent on the complex subsurface geology (Frank Saylor, California Department of Health Services, pers. comm. 3/3/97).

Floodplains and Flooding

Streams in the parks are typically small and steep and do not have well-developed floodplains. However, there are floodplains near the mouths of the larger rivers and in areas that are less steep (Klamath and Smith Rivers and Redwood, Mill, and Prairie Creeks). Along Redwood Creek the floodplain is best developed in the flatter downstream portion of the river, from McArthur Creek north to the national park boundary. Towards the south, in the upstream sections of the river, floodplains are discontinuous because of the steep valley sideslopes. The floodplain along Prairie Creek, a tributary of Redwood Creek, is relatively extensive and has commercial development, ranching activities, visitor facilities (including the Elk Prairie visitor center and campground), and the Davison Ranch structures.

Although not delineated, the campground at Mill Creek is probably within the 100-year floodplain. A small part of the Klamath River 100-year floodplain is within the parks' boundaries near the mouth of the river. No RNSP facilities are within the Klamath River floodplain. The Smith River flows through Jedediah Smith Redwoods State Park, and portions of the state park campground are in the 100-year floodplain.

The 100-year floodplains have been approximated for some areas of the parks' rivers (Zone A maps) by the Federal Emergency Management Agency (1982, 1983, 1986). Mapping of the 100-year floodplain in the parks has been done for the Smith River near Hiouchi and for Prairie Creek from the fish hatchery south to Orick. More detailed floodplain maps based on hydrologic studies and cross sections of the rivers are typically done in populated areas that have significant flooding risk and have not been done for Redwood National and State Parks.

Land use activities have increased runoff and sediment transport by the removal of vegetation for timber harvesting, agriculture, grazing, and mining. These activities have resulted in additional sediment being deposited in stream channels, reduced capacity and gradient, obstructed flows, and increased channel bed elevation.

The rivers and streams throughout the parks are subject to flooding, primarily due to the heavy amounts and seasonal concentration of precipitation (between November and March). Flooding near the mouths of the rivers is also commonly caused by high tides in conjunction with heavy rains and is often augmented by high winds. In Jedediah Smith Redwoods State Park, a 10-year frequency flood would overtop the banks of the Smith River in some areas. Flooding along the lower portions of Redwood Creek has decreased since construction of the federal flood control levees in 1968 because the water is now constrained by the levees. The flooding of January 1997 was estimated to be a five-year frequency flood on the Smith River, a 60-year frequency flood on the Klamath River, and an 11-year frequency flood on Redwood Creek (USGS 1997).

The highest recorded flood this century occurred during December 1964 when all of the river basins in the parks flooded. Peak flows of 50,500 cubic feet per second on Redwood Creek inundated Orick with 5 feet of water. High-water marks from this flood are still evident on trees throughout the parks. Extensive flooding also occurred in 1953, 1972, and 1975 (NPS 1985). Table 12 shows the flood frequencies and instantaneous discharges for the major streams in the parks.

Following the 1964 flood, local residents requested that the U.S. Army Corps of Engineers construct flood control devices that had been previously planned for lower Redwood Creek. In 1968 flood control levees were constructed on the lower 3.4 miles of Redwood Creek from the confluence with Prairie Creek downstream to within 1,000 feet of the Pacific Ocean (U.S. Army Corps of Engineers 1994). The levees were designed to protect Orick and the

surrounding areas with standard project flood protection. According to the 1966 "General Design Memorandum for the Redwood Creek project," the standard project flood for this area is for a discharge of 77,000 cfs, which is greater than the 71,600 cfs that the Corps of Engineers estimated in 1994 to be a 200-year event. Table 12 presents the most current estimates of stream discharges. The last 500 feet of the levees are within the national park boundary and are the only flood control structures within the parks.

Federal and state wild and scenic river designations for the Klamath and Smith Rivers preclude the construction of any water impoundment or flood control structures on these rivers. The mechanisms used to reduce flood damage on lands adjacent to the parks' rivers have been to control land uses and to use the regional flood warning system.

Estuaries

Within the parks' boundaries, there are estuaries at the mouths of the Klamath River and Redwood Creek. These estuaries (1) alternate between a fresh and brackish system and provide a transition and nursery area and migration route for anadromous fish, (2) are valuable habitats for a variety of fresh and saltwater species, (3) support recreational uses, and (4) supply water for farming and ranching activities in the valleys. Refer to the "Wetlands," "Floodplains," and "Water Quality" sections of the document for further discussion of the estuaries.

The Klamath River Estuary

Only a small portion of this estuary, at the mouth of the Klamath River, is under RNSP jurisdiction. The mouth of the Klamath River is dynamic and migrates across its floodplain. This estuary is accessible from local trails and beaches and provides RNSP visitors with a variety of recreational opportunities, including Yurok cultural activities at the Brush Dance site. The Yurok Tribe engages in a commercial fishery in the Klamath River estuary and subsistence hunting of eels at the mouth of the river.

TABLE 12: RECURRENCE INTERVALS AND INSTANTANEOUS STREAM DISCHARGE FOR MAJOR STREAMS IN THE PARKS (CUBIC FEET PER SECOND)

Recurrence Interval	Smith River Discharge ^a	Klamath River Discharge ^b	Redwood Creek Discharge ^c
2-year	76,300	135,000	20,800
5-year	110,300	231,800	33,400
10-year	133,500	304,000	41,800
25-year	163,700	402,600	52,300
50-year	186,700	480,600	59,800
100-year	210,000	561,800	67,100
200-year	233,900	646,500	74,300
500-year	266,500	764,000	83,400

SOURCE: Flood frequencies run by Rick Hunrichs, USGS, Sacramento, CA, March 1997. Discharge numbers have been rounded to the nearest hundred.

- a. Smith River, gaging station 11532500.
- b. Klamath River, gaging station 11530500.
- c. Redwood Creek, gaging station 1482500.

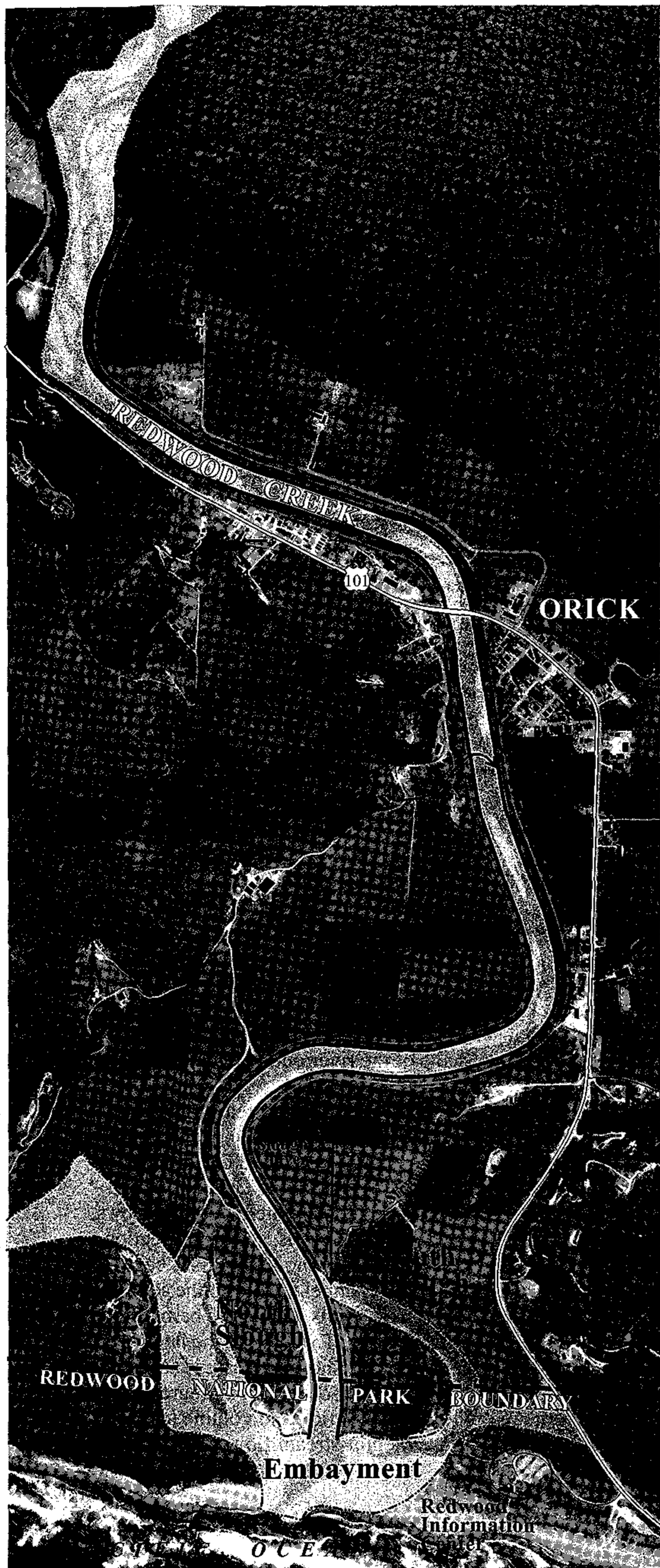
The Redwood Creek Estuary

Redwood Creek estuary is about 2 miles west of the town of Orick (see Redwood Creek Estuary map). The boundaries of the estuary are U.S. Highway 101 on the south and Hufford Road and a levee access road on the north. The downstream portion of the estuary is within the national park's boundaries, while the upstream portions are owned by the county, and land surrounding portions of the estuary (the sloughs) are in private ownership. The Redwood Creek estuary includes the embayment and the north and south sloughs of Redwood Creek. The mouth of the river is dynamic, and its location is affected by changes in discharge, bedload, size and direction of waves, and the tidal cycle.


Redwood Creek usually migrates between an unnamed point of land and several seastacks on the north, and the NPS Redwood Information Center on the south, although the river channel occasionally migrates further to the north and

south. Before construction of the federal flood control levees along lower Redwood Creek, the embayment at the mouth of Redwood Creek was a broad, relatively deep pool landward of the beach in the summer and fall. Water levels in the estuary fluctuate throughout the year, with changes in discharge, tides, sediment deposition, and the shape of the river outlet.

Following high winter flows, stream discharge begins to decrease, and during the summer low flows, a berm is built up seaward of the embayment at the mouth of Redwood Creek. This is a natural occurrence and is related to stream flows and ocean conditions (swells, size and direction of waves, and tides). Offshore processes begin to cause the outflow channel to shift to the south, and an embayment forms behind the berm as the outflow channel rises. Throughout the late spring and early summer, offshore processes cause the channel to shift to the south with a progressive increase in water elevation and volume in the embayment. When in-stream flows are greater



▲ To South Operations Center

Legend
 Existing 100-year Floodplain

ON MICROFILM

North  no scale

REDWOOD CREEK ESTUARY

Redwood National & State Parks • California
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than outflow, seepage, and evaporation, water levels in the estuary rise. During this time, the outflow channel may completely close and begin to flood private properties and roads in the lower Redwood Creek valley. About 95 acres of non-park lands may be subjected to flooding when Redwood Creek closes in the summer and fall (David Anderson, RNSP fisheries biologist, pers. comm. 7/97).

Water levels in the estuary have been controlled during the summer to alleviate high water caused by the closing of the embayment. In the past, uncontrolled breaching of the sand berm has been done to protect private property from flooding; this has been done by digging a trench through the narrowest part of the sand berm and draining water from the embayment. From 1982 through 1993, the National Park Service undertook a program of controlled breaching to protect adjacent lands from flooding while also retaining sufficient water to provide salmonid habitat. In 1992 a channel was excavated in the north slough to alleviate winter flooding there. Flooding of properties adjacent to the north and south sloughs may still occur in the summer and fall if the sand berm builds up and closes Redwood Creek.

Since the mid-1990s, the NPS policy has been to protect salmonid habitat from the adverse effects of an uncontrolled breach. The U.S. Army Corps of Engineers approved a section 404 permit for controlled breaching of the estuary during the summer and fall low-flow periods to protect fish habitat. Controlled breaching by RNSP staff prevents the occurrence of an uncontrolled breach that could have major adverse impacts on salmonid habitat. As a condition of the section 404 permit, the Corps stated that a longer term alternative should be pursued to manage water levels in the estuary. These measures may include the setback of levees, conservation easements, the raising of the county road above flood elevation, or outright land purchase in the lower Redwood Creek valley to protect the fisheries resource.

Redwood National Park was also issued another section 404 permit to allow emergency channel manipulation to protect the Redwood Informa-

tion Center from damage that could occur from the southward migration of Redwood Creek.

Federal flood control structures along the lower 3.4 miles of Redwood Creek constructed in 1968 have impaired the physical and biological functions in the estuary and have resulted in the loss of fish habitat, the reduction in biological productivity of the estuary, and degraded water quality (decreased dissolved oxygen and increased temperatures in the north and south sloughs). The levees have also changed the circulation and sedimentation patterns in the estuary and allowed sediment of marine origin to be deposited during winter storms (Ricks 1983). After the levees were constructed, the river bypassed the last meander in Redwood Creek and reduced circulation in the north and south sloughs, and about 50% of the lower estuary became filled with sediment and isolated from the embayment. Because of sediment infill in the north slough channel, lack of circulation and resulting poor water quality, it can no longer support juvenile salmonids.

During construction of the Highway 101 bypass around Prairie Creek Redwoods State Park from 1987-92, about 214,000 cubic yards of gravel were mined from between the levees of lower Redwood Creek. Mining removed point bars and pools, widened the baseflow channel, spread the flow out, and reduced water depths at lower flows. As recently as 1992, only 25% of the amount of gravel removed had been redeposited in the lower river.

Construction of the bypass has caused substantial increases in sediment in Prairie Creek and its tributaries (NPS 1996). A gated culvert was installed through the south levee in 1988 to mitigate for fisheries losses caused by the highway construction; the culvert was built to help improve water circulation, water quality, and summer rearing habitat for juvenile salmonids in the south slough. The project does not alleviate sediment buildup in the south slough outlet, which still impedes fish access and water circulation and degrades water quality (D. Short, RNSP geologist, pers. comm., 1997).

Using historical accounts and photographs of the estuary taken since 1948, staff have estimated that estuarine habitat for fish has been reduced by as much as 75% of its original extent.

Water Quality

The primary responsibility for water quality protection and enhancement in California has been delegated to the California Water Resource Control Board. In northern California, the North Coast Regional Water Quality Control Board is responsible for adopting and implementing the *Water Quality Control Plan* for the North Coast Region. The plan specifies objectives, requirements, and implementation plans to protect the beneficial uses of water in the north coast area, including the parks. Water quality objectives in the plan do not allow any degradation of surface or groundwaters or permit any alteration of natural conditions. The plan also specifies the maximum contaminant levels for point (discharge from a discrete point) and nonpoint (dispersed runoff) sources. For more information on water quality regulations and policies, see the topic of water quality in the "Regulations, Methods, and Assumptions" section of this document.

Water quality is determined by measuring various physical, chemical, and biological parameters, such as dissolved oxygen, nutrients, turbidity, suspended materials, water hardness, toxic substances, oil, and coliform. These indicators are compared to criteria (recommended limits) and standards (legal limits set to protect the public health) to determine water quality. Water quality criteria have been developed for its beneficial uses; use by people and domestic animals and aquatic organisms requires stricter water quality criteria than agricultural or industrial uses.

Water quality monitoring in and near the parks has been conducted by staff from the U.S. Geological Survey, the California Department of Water Resources, the California Department of Fish and Game, and Redwood National Park. Physical parameters (e.g., pH, temperature, alkalinity, and turbidity) are measured bimonthly

in Redwood Creek and the Klamath and Smith Rivers. Chemical parameters (minerals, nutrients, and metals) were measured in streams by the California Department of Water Resources through 1996, but these measurements are no longer done on a regular basis. Biological parameters (e.g., benthic macroinvertebrates and fecal coliform) are measured in Redwood Creek and some of its tributaries, the Redwood Creek estuary, Mill Creek, and in area wells. A baseline inventory of the aquatic communities in the freshwater environments of the three state parks was undertaken for the 1984 *General Plan (Inventory of Features, App AL-II)*. When necessary, special water quality studies are conducted in the region by the North Coast Regional Water Quality Control Board. Also, the Yurok Tribe has attained status as a state under the Clean Water Act and now regulates clean water through permit issuance in those portions of the Klamath Basin within the Yurok Reservation boundaries.

Overall, the water quality in the parks meets or exceeds the water quality objectives established by the North Coast Regional Water Quality Control Board, exception for Redwood Creek. Most levels of chemical, biological, and physical indicators in surface and groundwater supplies comply with primary and secondary water quality standards.

Redwood Creek was identified as having impaired water quality due to sedimentation in the state of California's 1996 and 1998 303(d) list submittal by the North Coast Regional Water Quality Control Board. The 303(d) list was developed in response to Section 303(d)(1)(A) of the Clean Water Act, which requires that "Each State shall identify those waters within its boundaries for which effluent limitations . . . are not stringent enough to implement any water quality standard applicable to such waters." The Clean Water Act also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish total maximum daily loads (TMDLs) for such waters. A total maximum daily load is defined as "the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" such that the capacity

of the waterbody to assimilate pollutant loadings is not exceeded.

The Environmental Protection Agency adopted a total maximum daily load for sediment in Redwood Creek on December 30, 1998. Beginning in 1998 in conjunction with the Environmental Protection Agency, the North Coast Regional Water Quality Control Board formulated a "Water Quality Attainment Strategy and Implementation Plan" to achieve the water quality objectives for the Redwood Creek watershed. Redwood National Park staff are actively participating in the development and implementation of the total maximum daily load both for parklands and with private landowners who request assistance from park staff.

Nonpoint source pollution is the major water quality concern in the parks; it is widespread and difficult to define and has resulted from long-held land use practices. Activities that have adversely impacted water quality in the parks are logging, mining, construction, ranching activities, sand and gravel operations, and wastewater effluent disposal. Elevated sediment levels entering Redwood Creek have made the river wider and shallower with lower streambank heights; this increased sedimentation has degraded aquatic habitats and streamside vegetation and water quality has deteriorated. The impacts from land use activities decrease towards the north, with the Smith River having the least amount of water quality degradation in the parks.

Water quality indicators in RNSP waters are elevated during certain times of the year, in large part due to current and past land use activities. Elevated levels of calcium and bicarbonate in stream waters are derived from the weathering of the underlying Franciscan complex rocks and are more pronounced in areas that have been harvested for timber. Specific conductance and alkalinity tend to decrease in logged watersheds, such as Redwood Creek basin, because during peak flows, overland flow contains lower concentrations of soil-derived solids than in forested watersheds.

Chloride levels are high in the parks, originating from the ocean where they are transported as dry

fallout, ocean spray, and rain. Seasonal variations in nitrate concentrations in the parks suggest that soil nitrate produced by fixation and organic decomposition early in the rainy season tends to wash out of logged watersheds and is taken up in tree growth in forested watersheds. In contrast, phosphorus, ammonium, and dissolved organic carbon accumulate in the soil during the dry season and are washed out and diluted as the rainy season progresses (NPS 1985, p. 16). Elevated levels of iron and manganese have been detected in the past in the water supply well at Prairie Creek Redwoods State Park, but the water is treated to comply with secondary water quality standards. Phosphorus and nitrogen concentrations in RNSP streams are generally too low to support excess algae but are high enough in some streams to support modest amounts of algae, particularly in the main stem where light levels are high (NPS 1985, p. 16).

Sewage Treatment

Wastewater is treated in a variety of ways in the parks. Effluent from the Crescent City headquarters and Arcata offices is treated at municipal wastewater treatment plants. The Requa maintenance facility has an onsite treatment plant. Other larger facilities, such as Redwood Information Center, have onsite septic tanks, leachfields, or chemical-type vault toilets. Smaller sites such as trailheads commonly have self-contained chemical toilets. Backcountry areas have either pit or self-composting toilets.

Water Quantity

Water Rights

California recognizes surface water rights based on the prior appropriation and the riparian doctrines. California recognizes both correlative and appropriative rights for groundwater. The rule of correlative rights holds that the right to make an overlying use of water is not absolute but is relative to the rights of other overlying users. The rule is used primarily when the

groundwater supply is insufficient to satisfy the needs of all sharing the water supply. In some cases, sharing is accomplished by prorating the supply on the basis of overlying acreage, although the recent trend suggests a more flexible approach. The prior appropriation doctrine allows the entity that first diverts water for beneficial use the right to use the water. Since December 19, 1914, exclusive means of making an appropriation was by permit from the California Water Resources Control Board. The requirement for a permit is applied to surface waters of subterranean streams flowing in known or definite channels. Under the riparian doctrine, water rights are subjected to the doctrine of reasonable use, which limits all rights to the quantity reasonably required for beneficial uses. Water must be used on the lands that are bordering the stream and may not be diverted out of the watershed.

The federal government may also hold reserved rights that arise from the purposes for which the land has been withdrawn from private ownership. When the federal government reserves land for a specific purpose, it also reserves, by implication, enough water unappropriated at the time of the reservation as is necessary to accomplish the purposes for which Congress or the president authorized the land to be reserved, without regard to the limitations of the state law.

Percolating groundwater is not within the jurisdiction of the California Water Resources Control Board. The owner of the land overlying a groundwater basin has the first right to withdraw water for a reasonable beneficial use on its overlying land. No permit is required for this type of appropriation.

Water Supply

Water supplies in the parks come primarily from wells and connections to community water systems. Public water system wells are issued water supply permits by the California Department of Health Services, and every water system is monitored monthly for mineralogical and bacteriological content. Surface water is the source of the water supplies for Mill Creek and Gold Bluffs Beach campgrounds, two residences and sea-

sonal cabins at Del Norte Coast Redwoods State Park, the Howland Hill Outdoor School, and Aubell. Groundwater aquifers are the water supply for Prairie Creek campground and buildings (residences and offices), Wolf Creek Education Center, Jedediah Smith campground and two residences, Requa facilities, and the Redwood Hostel. RNSP headquarters in Crescent City, Arcata NPS offices, Camp Lincoln, the Redwood Information Center, and the South Operations Center and seasonal trailers are supplied water from municipal water supplies.

Crescent Beach and the Crescent Beach Education Center currently do not have potable public water supplies, but the parks have considered hooking up to the Crescent City Community Service District (Mike Lewis, California Department of Health Services, pers. comm. 2/26/97 and Frank Saylor, California Department of Health Services, pers. comm. 3/3/97).

WETLANDS AND AQUATIC HABITAT

Redwood National and State Parks includes a wide variety of aquatic habitats and wetlands, ranging from headwater streams, large rivers, ocean shoreline, and deeper ocean waters. Abundant rainfall, a temperate climate, and varied topography create ideal conditions for the development of many different types of wetlands. Aquatic habitats, including sandy ocean beaches and rocky intertidal zones, are included in the descriptions of wetlands below.

Wetlands are defined by the National Park Service as any area classified as wetland habitat according to the U.S. Fish and Wildlife Service's *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin 1979). Wetlands types under this classification are referred to as "Cowardin wetlands." According to this definition, a wetland has at least one of three attributes: undrained hydric soils, predominantly hydrophytic vegetation, or, if the substrate is nonsoil, the area is saturated with water or covered with shallow water at some time during

the growing season of each year. The California Department of Parks and Recreation has used a less rigorous wetlands definition than the U.S. Army Corps of Engineers' definition, which generally requires evidence of all three attributes. However, this joint plan proposes to define wetlands in the state parks consistent with those in the national park, which is according to the USFWS classification.

Hydric soils are soils formed in a wet environment. Hydrophytic vegetation is defined as vegetation typically found in wet areas rather than on upland or dry sites. The growing season is defined as the frost-free period. In Humboldt and Del Norte Counties the growing season is considered to be March through October by the Natural Resources Conservation Service (formerly the USDA Soil Conservation Service), and year-round by the U.S. Army Corps of Engineers.

Wetlands types are taken from the 1987 *National Wetlands Inventory* topographic 7.5 minute quadrangle maps. The *National Wetlands Inventory* maps used the Cowardin classification. The classification begins with broadly defined "systems" — marine, estuarine, riverine, palustrine, and lacustrine— which are subdivided into more specific subsystems. The parks contain examples of all five systems. In the Orick area, where Redwood Creek runs at the base of forested hillslopes through its estuary to meet the Pacific Ocean, all five systems occur.

Each wetland system is divided into subsystems, which are subdivided by bottom type, or substrate, and water regime (duration and timing of inundation). Water regime can vary on a daily basis, such as in tidal wetlands; or a seasonal basis, such as normal high and low annual river flows; or an irregular basis, such as floodplains that are covered only during large floods. Areas that are classified as "irregularly exposed" are normally covered with water but sometimes dry — for example, rocky intertidal zones exposed only during very low tides.

The dominant vegetation — trees, shrubs, and emergents — is the most common (or in the case of trees, the largest) species or form of vegeta-

tion in a wetland. Emergents are erect, rooted, herbaceous wetland plants, excluding moss and lichens. The dominant vegetation has been used to define wetlands because it is easy to distinguish and does not change rapidly. Scrub-shrub wetlands include areas dominated by woody vegetation that is usually less than 20 feet (6 meters) tall. Scrub-shrub wetlands may eventually become forested wetland or may be relatively stable communities, such as willows along streams. Scrub-shrub and forested wetlands in the parks may be subdivided into broad-leaved deciduous or needle-leaved evergreen wetlands.

Representing the marine system in the parks are the rocky intertidal zone and sandy shoreline from Crescent Beach in the north down the coastal bluffs to Freshwater Lagoon Spit beach in the south. These areas are periodically covered with water by waves and tides.

Estuarine wetlands are tidal habitats that are partly enclosed but may have periodic access to the open ocean. Ocean waters are at least occasionally diluted by freshwater runoff. Examples of the estuarine system are found where rivers and streams meet the ocean — at the mouths of the Klamath River and Redwood Creek and along Gold Bluffs Beach. Espa Lagoon, an estuarine wetland, has been converted into a coastal pond by the construction of the road, with its small, fixed invert culvert system, and by the stabilization of the beach due to introduced beach grass. RNSP estuarine wetlands may have sandy or unconsolidated bottom substrates or may be streambeds. The Redwood Creek estuary contains the largest variety of estuarine wetland types because of the variety of flooding regimes. Water regimes vary from irregularly flooded at the south slough to irregularly exposed for the north slough. The mouth of the Klamath also has an extensive system of associated wetlands.

Wetlands within the floodplains of larger streams and rivers may be classified as riverine if flowing water has a greater influence than groundwater. The parks contain a broad range of the riverine wetlands, from headwater drainages to small intermittent streams to large rivers, with a correspondingly broad range of bottom

substrates and flooding conditions. Water is usually flowing in riverine wetlands. The riverine system includes wetlands that are bounded by a river or stream channel, except for some wetlands that are dominated by trees, shrubs, and persistent emergent vegetation. Some riverine wetlands are influenced by tidal action on a seasonal or permanent basis. The mouths of the Klamath River and Redwood Creek are examples of riverine wetlands that are influenced by ocean tides. Riverine wetlands include areas that range from permanently flooded to seasonally flooded.

Riverine wetlands in the parks include intermittent headwater streams in the channels at the bottom of steep, well-drained slopes. Smaller streams either drain into larger streams or rivers, for example Ah Pah Creek, Boyes Creek, and Bridge Creek, or directly into the Pacific Ocean. Cushing Creek, Nickel Creek, Squashan Creek, and Major Creek are examples. Riverine wetlands are very common around Hiouchi and Jedediah Smith Redwoods State Park. Riverine and palustrine (see below) wetlands are very common in the parks because the steep, dissected topography; abundant rainfall, and temperate climate create streams and rivers bordered with vegetation.

Palustrine wetlands are defined as nontidal areas dominated by trees, shrubs, and persistent emergent vegetation. These wetlands best fit the common notion of wetlands and have traditionally been called marshes, swamps, and bogs. Small, shallow, permanent or intermittent bodies of water called ponds are also classified as palustrine. Areas only temporarily flooded at the highest water levels are included in the palustrine system. Among the areas classified as palustrine wetlands are the coastal ponds at Crescent Beach; some of the diked and impounded agricultural lands near the Redwood Creek estuary; and two artificial impoundments created for logging mills — Marshall Pond on Richardson Creek that formerly drained into the south bank of the Klamath near the mouth, and the Lagoon Creek pond near False Klamath Cove.

Marshall Pond contains an estimated 5–10 acres of palustrine wetland around its edges. The pond

was formed by damming Richardson Creek to create a log holding pond for an adjacent lumber mill that used to operate there. Richardson Creek enters the Klamath River about 2 miles upriver from the Pacific Ocean. Wetland values of Marshall Pond include habitat for fish, amphibians, breeding waterfowl, and other wildlife, and recreational and aesthetic benefits for hikers passing the pond on the Flint Ridge portion of the Coastal Trail. A 1988 survey of the pond by NPS biologists found four fish species, three of which were introduced warm-water fish. The only native fish was the three-spine stickleback.

Salamander larvae, steelhead or coastal cutthroat, coho salmon, and two other native fish were obtained by electroshocking the riffle and pool habitats in Richardson Creek. Local American Indians report (Redwood National Park memo dated 3/26/85) that Richardson Creek once supported a higher salmonid population than with the dam in place. Waterfowl observed at the pond include rails, wood ducks, ringneck ducks, and hooded mergansers. Wood ducks breed at the pond.

The Lagoon Creek area is estimated to include about 5 acres of palustrine wetland. Lagoon Creek is scenic and provides wildlife habitat; it also is used for recreational fishing. The pond is stocked with rainbow trout by the California Department of Fish and Game under an agreement between the national park and the State Wildlife Conservation Board.

Lacustrine wetlands are defined as areas greater than 20 acres lacking trees, shrubs, or emergent vegetation. The lacustrine system is represented only by Freshwater Lagoon. The natural processes and functions of Freshwater Lagoon have been greatly impacted by the construction of Highway 101 across its spit and the installation of a culvert to maintain water levels below the level of the highway surface. This lagoon can no longer breach, overwash is severely limited by fill on the spit, and subsurface flow between the lagoon and ocean has been affected by soil compaction during road construction and the introduction of earthen fill across the spit.

PLANTS

Note: The primary reference for this section is Olive et al., (CDPR 1982 & 83; also see appendix G).

There are many ways to classify vegetation. In this document, vegetation is grouped broadly by habitat types or communities that are generally based on the dominant plant species. A species or group of species, such as grasses or trees, may be dominant either in terms of numbers present or in area covered or even the size of the plant. The dominant species in a forest is often the tallest tree species.

Forests are the predominant vegetation type in the parks, with prairies and oak woodlands, brushlands, and coastal plant communities also present. The serpentine soils that occur in the northern parts of the parks often support different vegetation than the surrounding areas, including rare or unique species.

The Redwood Forests

The redwood forest is dominated by coast redwood (*Sequoia sempervirens*) and Douglas-fir (*Pseudotsuga menziesii*). Associated species depend on local conditions such as whether a site is upland, riparian (streamside), alluvial (along a floodplain), or close to the ocean. Other coniferous trees are grand fir (*Abies grandis*), Sitka spruce (*Picea sitchensis*) in lowland and coastal areas, and western hemlock (*Tsuga heterophylla*) in moist habitats. Conifers other than redwood may be the dominant species in some forest stands where soil, temperature, moisture, and ocean salt-spray do not favor redwoods. Old-growth forests occupy about 40,000 acres in Redwood National and State Parks.

Hardwood species are generally overtopped by conifers in redwood forests but occasionally dominate a stand. Major hardwoods are tanoak (*Lithocarpus densiflora*), madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), California bay or laurel (*Umbellularia*

californica), and red alder (*Alnus rubra*). Except for madrone, all these hardwoods occur in both riparian and upland areas.

Moist lower slopes have the lushest understory found in redwood forest communities. The dominant understory species of the redwood forest are oxalis (*Oxalis oregana*) and sword fern (*Polystichum munitum*). Other common understory plants are rhododendron (*Rhododendron macrophyllum*), huckleberry (*Vaccinium* spp.), salal (*Gaultheria shallon*), azalea (*Rhododendron occidentale*), and several types of berry (*Rubus* spp. and *Ribes* spp.). Middle and upper-slope positions are characterized by evergreen shrubs (salal, rhododendron, and huckleberry).

The presence of fog is often associated with the range of redwoods, but no known causal relationship exists. The summer fogs reduce insolation (how much sunlight reaches an area) and provide a moisture source during generally rainless summers. Inland and upslope away from the summer fog zone, forests become drier and the redwoods become less numerous.

Dry Forests

Dry forests, which include mixed evergreen forest, Jeffrey pine, and knobcone pine forests, are found in the eastern parts of Jedediah Smith Redwoods State Park. In the Redwood Creek basin, dry forest types occur from the Lacks Creek drainage and upstream.

The mixed evergreen forest found inland from the redwood forest is dominated by Douglas-fir, tanoak, and madrone. California bay, bigleaf maple, chinquapin (*Chrysolepis chrysophylla*), canyon live oak (*Quercus chrysolepis*), and poison oak (*Toxicodendron diversilobum*) are also common in this forest type.

The Jeffrey pine/chaparral/knobcone pine vegetation type includes several distinct vegetation types that are grouped here because they are localized in the Little Bald Hills, an area of about 1,300 acres in the eastern portion of Jedediah

The Coast Redwoods

Redwoods are the dominant species in the parks and the reason why Redwood National and State Parks were established — to preserve them. The following provides some information about these wonderful trees.

*Fossil redwoods have been found in rocks estimated to be more than 160 million years old. Redwoods were formerly widely distributed throughout the northern hemisphere. With long-term climate and topographical changes, redwoods gradually were restricted to areas of relatively mild climate. The range of the coast redwood (*Sequoia sempervirens*) in modern times extended from the extreme southwest corner of Oregon southward along the summer fog belt of the California Coast Range to the Santa Lucia Mountains of Monterey County, a zone 450 miles long and up to 40 miles wide.*

*The coast redwood reaches the greatest height of any known modern tree, at more than 350 feet. Redwoods are much taller yet smaller in diameter than the closely related giant sequoias (*Sequoiadendron gigantea*) found in the Sierra Nevada Mountains of central California. Coast redwoods are not known to exceed 21 feet in diameter at breast height. The greatest age known to have been attained by a coast redwood is 2,200 years. The average age of trees in old-growth stands ranges between 400 and 800 years old.*

Coast redwoods in Redwood National and State Parks occur from sea level to ridgetop. Redwoods grow at elevations up to about 3,000 feet. Trees growing near the sea must contend with strong ocean winds and wind-borne salt. Redwoods have a low tolerance for both conditions. The best development of pure dense stands of coast redwoods throughout their range occurs in Humboldt and Del Norte Counties, on alluvial deposits and riverbottoms that are sheltered from coastal winds.

The tallest redwoods grow on alluvial flats. The growing season in alluvial stands is year-round, with maximum growth from late spring to early summer. On upland slopes, trees are shorter, the diversity of other tree species is greater, and the understory is more shrubby. The long life span and massive size of redwood trees result in forests of the greatest accumulation of weight of living material known (Franklin 1988).

Redwood trees reproduce both by seeds and by sprouting. Sprouting is strongly developed in redwoods and contributes to its ability to persist through disturbance. Wind-blown branches, fallen trees, burls, broken tops, and fire-damaged trees all have the ability to sprout.

Redwood sprouts grow extremely rapidly, followed by slower growth (up to 14 inches in height annually) of seedlings for four or five years, then another rapid growth period for up to 20 years. Large mature trees grow an average of 4–5 feet in height annually.

Smith Redwoods State Park and adjacent national park. Despite almost 100 inches of annual precipitation here, these communities have sparse vegetation due to serpentine soils, which have high concentrations of heavy metals such as magnesium and few nutrients available for plants because of high pH and poor water

holding capacity. These harsh growing conditions have resulted in the development of specialized plant communities with many unique plant species.

The driest ridgetops are occupied by widely scattered Jeffrey pine (*Pinus jeffreyi*), while a

chaparral vegetation type downslope is dominated by manzanita (*Arctostaphylos* spp.), golden chinquapin (*Chrysolepis chrysophylla*), rhododendron (*Rhododendron macrophyllum*), huckleberry oak (*Quercus vaccinifolia*), and other evergreen shrubs, interspersed with stands of knobcone pine (*Pinus attenuata*). Port-Orford-cedar (*Chamaecyparis lawsoniana*) is found here.

The knobcone pine vegetation type in the parks is a dense forest of small-diameter, mostly even-aged pines. Knobcone pines may be restricted to serpentine soils and are subject to frequent fires because of their association with other fire-dependent vegetation, xeric growing conditions, and early senescence, which adds to the fuel layer. Knobcone is a successional stage that in the absence of fire gives way to Douglas-fir, madrone, and tanoak. Based on tree fire scar examination and post-fire regeneration, the last known fire in the knobcone pine vegetation type was about 1940, according to the 1994 Redwood National Park *Fire Management Plan*.

Prairie and Oak Woodland Vegetation

The most extensive prairie vegetation type in the parks is in the Bald Hills, on the eastern watershed divide of Redwood Creek. The Bald Hills prairies are a distinct vegetation community as identified by Holland (1986) but the term "Bald Hills" in the national park includes a complex mosaic of vegetation types including prairies, Oregon white oak (*Quercus garryana*) woodlands, and coniferous forest. The Bald Hills include about 1,500 acres of Oregon white oak woodland and 2,500 acres of prairie. Smaller prairies or grasslands include those at Davison Ranch, Elk Prairie and Ossagon Prairie in Prairie Creek Redwoods State Park, and DeMartin, Crescent Beach, and Deer Meadow in Jedediah Smith Redwoods State Park. Some of these prairies may be the result of human activity, including tree cutting, livestock grazing, and repeated burning.

The extent of the Bald Hills prairies is determined by a number of factors, including soil

type, slope, aspect, landform position, present and past climate, plant succession processes, and fire history. The extent of the prairies may be determined by physical and chemical soil conditions rather than climate, although the prairies tend to be beyond the limit of coastal fog (Holland 1986). The prairies occur in areas of clayey fine-textured soils on ridge crests, usually a few miles from the coast in the zone of mixed evergreen and coniferous forests, in patches from Sonoma County, California, to southern Oregon.

Humans may have had a profound influence on the ecological processes thought to have perpetuated the Bald Hills prairies over thousands of years (Popenoe et al. 1992). Before the arrival of Euro-Americans around 1850, American Indians traditionally used fire to increase the amount of seeds, basketmaking materials, and forage for deer and elk. Euro-Americans brought livestock and nonnative pasture plants and built roads. The roadsides were colonized by woody species. By the middle of the 20th century, the deliberate burning of grasslands had ceased. Douglas-fir, which is killed by fire in its first few years, was able to establish in increasing numbers. The Douglas-fir grew very rapidly in the moist, mild climate, and began to take over large areas of prairie and oak woodland. RNSP staff instituted a program of prescribed fires (planned ignitions) and cutting to remove encroaching Douglas-fir and restore fire as a process.

Native grasses and forbs make up two-thirds of the species in the Bald Hills, but nonnative pasture grasses predominate in cover. Three native species are common: a sedge (*Carex tumicola*), California oatgrass (*Danthonia californica*), and blue wildrye (*Elymus glaucus*). The most common nonnative species are tall oatgrass (*Arrhenatherum elatius*), sweet vernal grass (*Anthoxanthum odoratum*), velvet grass (*Holcus lanatus*), dogtail (*Cynosurus echinatus*), soft chess (*Bromus hordeaceus*), plantain (*Plantago lanceolata*), and sheep sorrel (*Rumex acetosella*).

Oregon white oak woodlands are found on drier, warmer slopes and canyon bottoms in the Bald Hills. Black oak (*Quercus kelloggii*), California bay, and big-leaf maple are found near rock outcrops and stream channels. Douglas-fir occurs

on rockier sites. White oak stands with older, larger-trunked, wide-crowned trees surrounded by younger, narrow-crowned trees have burned less frequently (James Popenoe, RNSP soil scientist, pers. comm., 12/3/97).

Brushlands

Brushlands dominated by shrubby species occur among other types of vegetation throughout the parks where harsher conditions such as drier, gravelly, or sandy soils occur, or in areas subject to high velocity floodwaters such as the floodplain of the Smith River. The most common brushland species include manzanita (*Arctostaphylos* spp.), *Ceanothus*, coyote brush, mountain mahogany (*Cercocarpus betuloides*), and poison oak.

Coastal Vegetation

Coastal vegetation types include coastal strand, vegetation that grows on sand dunes, and coastal shrub. Coastal vegetation is subject to wind and salt spray. The sandy soils are well drained and may not be stable. Some areas exhibit wind pruning because of strong, constant winds. Two sensitive plant species, the pink sand verbena (*Abronia umbellata* ssp. *brevifolia*) and Wolf's evening primrose (*Oenothera wolffii*), occur in coastal vegetation types.

Coastal strand is dominated by low-growing salt-tolerant plants like sand verbena (*Abronia latifolia*) and sea rocket (*Cakile maritima*) scattered throughout the sandy areas. This vegetation may be washed by storm waves during winter high tides.

Sand dunes occur at Crescent and Gold Bluffs Beaches and at Freshwater Lagoon Spit. The vegetation that grows on dunes along the ocean is subject to incessant desiccating, salt-bearing breezes. Shifting sands around alien European beach grass are invaded by species tolerant of sand cover, which are then able to spread over larger areas and stabilize those areas. This creates suitable habitat for species that are not

tolerant of sand burial — first low-growing or herbaceous vegetation and then shrubs and trees. At Gold Bluffs Beach, succession is visible as beach grass on dunes facing the ocean are being invaded by lupine, coyote brush, and Sitka spruce on the back dunes. As succession proceeds, alder groves have become established on the alluvial flats created by the numerous creeks that drain from the bluffs onto the dunes. At Gold Bluffs Beach, sand deposition and stabilizing effects of alien European beach grass may have allowed dunes to form. According to historical reports, waves broke on the bluffs; there were no beaches or dunes.

Coastal shrub generally occurs on a narrow strip between dunes and coastal coniferous forest. Although subject to less wind and salt spray than dunes and strand communities, vegetation may still exhibit wind pruning and may take on a low or prostrate form. Coastal shrub includes areas dominated by evergreen shrub species, wind-pruned trees, or low-growing shrubs intermixed with herbaceous species and grasses. Coyote brush (*Baccharis pilularis*), salal (*Gaultheria shallon*), salmonberry (*Rubus spectabilis*), lupine (*Lupinus* spp.), and oceanspray (*Holodiscus discolor*) are common species. The most common wind-pruned trees are Sitka spruce and red alder.

Plant Succession and Natural Disturbances

Ecological succession is a sequence of changes in the number or type of plant species found in an area. Each succeeding associated set of plants is called a sere, or seral stage. An associated set of plants (a plant community) that remains relatively stable through time and is self-sustaining even in the presence of some disturbance is called a climax community, and the vegetation is called climax vegetation.

Both natural and human-caused disturbances can create changes in plant communities and alter succession. The effects of naturally occurring fire on the redwood forest ecosystem are covered in this section. The next section covers the

effects of human-caused fires and fire suppression.

Following disturbance, whether natural or human-caused, a forest matures through various stages and acquires a set of characteristics that define it as old growth. Seral stages in forests include stand initiation, stem exclusion, understory reinitiation, and old growth. The stand initiation stage covers invasion of the forest opening. Stem exclusion describes the stage where all available space is occupied by invaders. In understory reinitiation, gaps reappear in the canopy and allow light to penetrate; understory species can then grow. Old growth is defined in this sequence as the stage when the original invading trees are beginning to be replaced by young trees again (Oliver 1981). Old-growth redwood and Douglas-fir forests are characterized by large gaps between old trees, many age classes of trees from young to old, a multistoried canopy, large snags (dead trees), and large downed logs.

RNSP staff is managing the redwood forests to return natural processes of ecological succession to these areas. Natural physical disturbance factors affecting the redwood forest are flooding, fire, wind, and slope instability. The Bald Hills prairies and oak woodlands are managed to restore processes necessary for their perpetuation. Bald Hills prairies and oak woodlands are being invaded by Douglas-fir forest, probably as a result of fewer natural and human-set fires.

Coastal redwood is not dependent on fire for cone sprouting as is the giant sequoia. The regeneration of redwood forests was once believed to depend on disturbances such as fire or flood (Stone 1966 and 1967; Stone and Vasey 1968). Analyses of different ages of trees in logged stands have shown that redwood can reproduce enough to keep the population stable, even in the absence of catastrophic disturbance (Veirs 1980).

Flooding has both positive and negative effects on streamside forests. The tallest redwood trees grow on the alluvial flats adjacent to the major streams. Alluvial flats are the product of repeated flooding and can be both produced and removed

by major floods. Fine-grained silts and abundant moisture in alluvial flats encourages seedling establishment. Coast redwood is favored over other tree species in the alluvial flats because of its ability to tolerate flooding. It adapts to successive inundation by growing a new set of surface roots in the new soil layer.

Fluctuations in the water table can adversely affect roots and seedlings in alluvial flats. Aggradation of streams can accelerate bank erosion and directly topple trees or undercut banks and expose or weaken roots; aggradation can also raise the water table and drown tree roots. The deposition of gravel can smother seedlings. Permanent lowering of the water table can preclude redwood survival by removing needed moisture from the roots.

Moist coastal redwood forests in low elevations, especially alluvial stands, have a lower incidence of fire than upland drier Douglas-fir forests. Fires that are not intense enough to open the canopy favor the regeneration of western hemlock but usually eliminate the older hemlock trees. Douglas-fir establishment through seedlings is infrequent under a closed canopy. Douglas-fir appears to be favored by fires of great intensity that open the canopy and allow light and heat to penetrate to the forest floor.

Lightning fires are not frequent near the coast in northern California, but their importance as an ignition source increases with elevation and distance from the ocean. Intense fires occur at intervals of greater than 500 years in more mesic lowland sites, 150–200 years on mid-elevation and coastal upland slopes, and 50 years on hotter, drier inland slopes (Veirs 1980). Other research suggests that fires in mid-elevation redwood forests may occur as frequently as every 10 years (Brown and Swetnam 1994).

Wind affects redwoods by breaking off stems and branches and creating windfalls that may include the roots. Heavy winter precipitation saturates and softens soils, and intense winds then topple shallow-rooted redwoods. Openings in the canopy also increase the likelihood of windfall. Soil compaction contributes to

vulnerability to windthrow (trees being uprooted by wind).

Landslides are another physical process that can topple trees and create forest openings. There are examples of landslides where trees have been toppled near the Tall Trees Grove .

Existing and Past Human-Caused Disturbances

Logging has had the greatest impact on the natural vegetation in the parks. Most of the timber harvesting in what is now Redwood National Park occurred between 1950 and 1978. The national park contains between 45,000 and 50,000 acres (a little less than half the total acreage of all four parks) of second-growth forests that are in various stages of regrowth. The term second growth is used here for forests or stands that regrew after logging. Some stands may actually have been cut more than once. Most of the second-growth forests in the national park were added in the 1978 park expansion and are in the Redwood Creek basin. Of the more than 30,000 acres within the three state parks, about 4,400 acres have been logged since the late 1800s.

Vegetation in second-growth stands depends on the dominant vegetation at the time of cutting, how long ago the area was cut, which species were harvested, whether the cutting was selective or clearcut, the physiography of the cut area (slope, aspect, soil type, elevation), and whether the cutover areas were replanted and the method of replanting (seeding or planting seedlings).

Logging in old-growth was once primarily by the seed-tree method, where selected trees were left as a seed source for new growth and removed later. The dominant timber harvest method in the Redwood Creek basin in what later became part of the parks was clearcut logging combined with seeding or planting to ensure revegetation, followed by thinning to produce higher value timber in a short period. Thinning is the usual practice in timber manage-

ment to ensure that the plantings reach merchantable size in a shorter period of time.

The pattern of plant succession after timber harvest depends on the conditions at the particular site. In general, the pattern of plant succession after timber harvest begins with short-lived annual and biannual herbs in the first three years followed by the development of shrub communities, either from remnant plants that have survived timber harvest and flourished or from invading species capitalizing on the disturbed environment. Eventually, reduced light levels eliminate all but the most shade tolerant species.

Future dominant tree species are usually present as seedlings in each early succession type. Following logging, short-lived weeds dominate for about five years. Hardwood shrubs become abundant in 6 to 10 years following logging and dominate for 11 to 20 years.

In the redwood/Douglas-fir forests in the parks, thickets of red alder developed after timber harvest, especially on lower slopes near streams and other wet areas. These thickets are followed by Douglas-fir and redwood in the understory as the site stabilizes. Alder dominance may continue for 50 to 80 years. If disturbance continues, as might occur in landslide areas due to the presence of roads or unstable slopes, alder may replace itself.

On drier sites, brush may invade, especially blueblossom (*Ceanothus thyrsiflorus*) and coyote brush. Both alder and blueblossom are nitrogen fixers and contribute to the productivity of the soil. Alders colonize naturally from around streams at the base of a slope in response to disturbance by landslides and flooding, whereas blueblossom colonizes ridges and upper slopes in response to fire.

Old-growth forests differ from unmanaged second-growth forest in the numbers of individual trees, numbers of tree species, and age structure of trees. Second-growth stands feature trees of the same age. These even-aged stands are very different from old-growth stands that

contain a variety of different age classes, from seedlings to old trees.

There are more Douglas-fir trees relative to the number of redwood trees in the second-growth forests than in uncut forests in the parks (Stephen Underwood, RNSP supervisory botanist, pers. comm., 12/96). Following timber harvest, the stands were seeded or planted with a mix of coniferous species but never thinned. Because the majority of the seed planted was Douglas-fir that had a high survival rate, most second-growth stands are dominated by Douglas-fir. The density of trees in stands of 20-year-old second-growth forest ranges from 1,750 to 2,350 trees per acre (Cussins 1994, Veirs 1986, Veirs and Lennox 1981). Some second-growth stands in the parks contain 10,000 small Douglas-fir trees per acre, with very few redwood trees (Veirs 1986). In contrast, old-growth stands contain between 10 and 35 large trees, some of which may be Douglas-fir (Veirs 1982).

Forest stands sampled in the parks exhibit a ratio of redwood to Douglas-fir in the canopy of old-growth stands typically ranging from 10:1 to 3:1, depending on individual stand history. In young second-growth stands, the situation is reversed, with Douglas-fir outnumbering redwood by a factor of 10:2, depending on slope positions and aspect. Early experiments on thinning 25-year-old second-growth plots in the national park demonstrated that thinning can produce stands with species ratios similar to untreated 60-year-old stands (Veirs and Lennox 1981).

The role of fire in managed forests differs from its role before EuroAmericans intervened into the fire history of an area (CDPR 1982 & 1983, Olive et al.). Burning by American Indians was eliminated, and a vigorous program of suppression of both man-caused and lightning-caused fire was instituted. Fire suppression has probably had little or no effect on bottomland redwood forests or in the fire potential there, except in drought years (Veirs 1972 and 1980). Suppression has had a greater effect in upland mixed evergreen and Douglas-fir dominated forests where drier conditions allow lightning-caused fires to spread. Fire suppression also increases the amount of down wood that acts as fuel, so

that when a fire does start, it is likely to be much more intense in those areas where fires have been suppressed (CDPR 1982 & 1983, Olive et al.).

American Indian burning was conducted in specific areas in the redwood region, including in and around higher elevations in the grasslands and oak woodlands above the forests (CDPR 1982 & 1983, Olive et al., p. 33.). The purpose was to produce seeds and basketmaking materials, including five-fingered ferns, spruce root, and hazel, as well as to create forage for deer and elk that were hunted for meat. Burning in tanoak groves cleared the ground beneath the oaks so that acorns could be collected (Schenck and Gifford 1952).

These fires, under most conditions, would only carry in the fine fuel, such as grass, and would not spread in the coarser and moister forest fuels. However, with the drying winds and lack of rain in late summer, prairie fires can spread through upland forests.

American Indian burning was apparently most influential upon the vegetation at higher elevations and south-facing slopes, such as the prairies and oak woodlands above the forest (CDPR 1982 & 1983, Olive et al.). American Indian burning in the Bald Hills woodlands and prairies probably had a major influence on fire frequency in the adjacent redwood forest, but the magnitude of these burns in comparison to lightning-caused ignitions cannot be quantified with the available data.

Timber harvest increases the amount of ground debris that serves as fuel. Harvested stands were routinely treated for slash removal, often through controlled burning. Second-growth forests that were not thinned as intended under a commercial management regime have a greater chance of large and intense fires than old-growth forests, which tend to be damper. Second-growth forests in the parks contain a greater amount of fuels that allow a ground fire to move up into a canopy.

Harvested areas open up the forest and increase the susceptibility of wind effects. Wind effects

include limb breakage, tree mortality, and wind-throw (trees uprooted or breaking due to force of wind). Potential for wind effects is greatest where clearcuts are right up to RNSP boundaries.

Nonnative plants, also called exotic or alien species, quickly colonize disturbed habitats throughout the parks but may also invade undisturbed native vegetation. Estimates of the percentage of nonnative range from about 20% to 25% of the total of about 850 species.

Several factors have contributed to the replacement of native species by nonnatives in the parks — the introduction of highly competitive nonnative species, the increase in grazing, the elimination of periodic fires, the cultivation of food and horticultural plants, ground disturbance from timber harvest, windborne seeds, intentional introductions, and the presence of highway corridors.

Old-growth redwood forest is too shady for some nonnative plant species. Timber harvest opens the canopy and allows the invasion of species such as pampas grass (*Cortaderia jubata*). Regrowth of the forest shades the ground, causing some nonnatives like pampas grass to die out. Other invasive nonnatives such as English ivy (*Hedera helix*), English holly (*Ilex aquifolium*), and cotoneaster (*Cotoneaster* spp.) survive in the shade and displace native species.

Soils along roads are particularly susceptible to invasion by alien plants. The soils are continually disturbed for road maintenance and also have a continual source of seeds from vehicles, maintenance equipment, and gravel shipments.

Some of the nonnative plants disrupt natural ecological processes, degrade native wildlife habitat, and displace native vegetation. Some nonnative plants have been assigned high priority for control in the parks. Tansy ragwort (*Senecio jacobaea*) and Canada and bull thistle (*Cirsium arvense* and *C. vulgare*) are unpleasant, unpalatable, and/or toxic to wildlife. European beach grass (*Ammophila arenaria*) degrades native plant and snowy plover habitat by trapping sand and burying native plants. European

beach grass, pampas grass (*Cortaderia jubata*), Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*), and Himalaya berry (*Rubus discolor*) shade out lower growing native vegetation. In contrast, English holly, cotoneaster, and English ivy are long-lived, shade-tolerant species that invade the understory of native forests and gradually outcompete the native plants. Recently discovered nonnative species — purple knapweed (*Centaurea* spp.), a noxious weed related to star thistle, and Peruvian lily (*Alstromeria aurantiaca*), an aggressive plant that has escaped from cultivation (garden escape), are being targeted for control.

Some plant species found in the parks are native to California but not to the north coast region or the parks. These species have become established in the parks through planting for commercial harvest or for horticultural purposes. Monterey pine (*Pinus radiata*) and Monterey cypress (*Cupressus macrocarpa*) are examples. Neither of these species occurs naturally in northwestern California, but both thrive when planted. Monterey pine was aerially seeded in 1967 in about 180 acres in the Tom McDonald Creek area in the Redwood Creek basin following timber harvest. The pine was also planted along Highway 101 in some areas in the parks. Research on the stand in the Redwood Creek basin suggests that, in the absence of fire, the pine will die out because seedlings will not compete with native trees.

Nonnative plants are controlled under a program described in the NPS 1995 *Exotic Plant Management Plan*, the 1985 *State Redwood Parks General Plan*, and the California Department of Parks and Recreation's *Resource Management Directives*. The national park plan describes objectives, strategies, and control techniques; assesses threats; and assigns a priority for species to be controlled. Control efforts are directed where there is significant risk to other species or ecological processes and where successful control is both economically and biologically likely. Methods of control on unwanted plant species include mechanical removal by hand or with tools; burning to remove standing plants and perhaps sterilize the soil of seeds; biological control such as the use of target-specific plant

pests or pathogens; and chemical control as a last resort. Often a combination of control techniques is necessary. Each location and target species requires a specific prescription and usually repeated attempts for successful control.

WILDLIFE

Animal species diversity is lower in the upland redwood forest community, especially the younger-aged redwood forest community, in comparison to other plant communities (such as riparian forests) because of lower plant diversity and less structural complexity in the canopy. The mosaic of forest, prairie, streamside, aquatic, and coastal areas provides habitat diversity for wildlife.

The moist cool coastal environment of the old-growth forest favors salamanders and frogs over lizards and snakes, which are more common in the drier prairies and oak woodlands. Pacific treefrogs (*Hyla regilla*) are common in marshes, meadows, woodlots, brush, and disturbed areas. Northern red-legged frogs (*Rana aurora aurora*) are common in some parts of the parks. These frogs use the coastal ponds inland from Crescent Beach and other open bodies of freshwater associated with wetlands and sloughs for breeding. The closely related California red-legged frog (*R. a. draytonii*) that inhabits areas south of the parks is listed as a threatened species. The relationship between these two subspecies north of Marin County, California, is poorly understood (*Federal Register* 1994). The northern red-legged frog is declining in British Columbia, Washington, and Oregon (Hayes and Jennings 1986); many of the coastal watersheds that the northern red-legged frog inhabits have sustained significant alteration related to timber harvest (California Department of Forestry and Fire Protection 1988). Because of the threat to the northern red-legged frog in the northern part of its range, as well as to amphibian populations throughout California, the parks' populations of red-legged frogs should be monitored (California Department of Fish and Game 1994; Sean J. Barry, UC Davis School of Medicine, pers. comm. 8/18/97).

The salamanders include the northwestern salamander (*Ambystoma gracile*), Pacific giant salamander (*Dicamptodon tenebrosus*), southern torrent salamander (*Rhyacotriton variegatus*), the rough-skinned newt (*Taricha granulosa*), Del Norte salamander (*Plethodon elongtus*), Ensatina (*Ensatina eschscholtzii*), three species of arboreal salamander (*Aneides*), and California slender salamander (*Batrachoseps attenuatus*).

Reptile diversity is generally low in old-growth forests, and there are fewer lizards in these areas as well. Pond turtles occasionally occur in streams and ponds formed by logging. The highest diversity of snakes and lizards is found in drier upland areas of Jedediah Smith Redwoods State Park and in the Bald Hills prairies and oak woodlands. Northwestern and western terrestrial garter snakes (*Thamnophis ordinoides* and *T. elegans*), racers (*Coluber constrictor*), and gopher snakes (*Pituophis melanoleucus*) are the most common snakes. Western fence lizards (*Sceloporus occidentalis*) and northern fence lizards (*Elgaria coeruleus*) are the most common lizards.

More than 400 species of birds have been reported in the parks, 200 of which are known to breed in the parks. Slightly more than 100 of these species are neotropical migrants (birds for which the majority of the population winters south of the Mexican border). Most of these neotropical migrants are songbirds, which have only recently been recognized as seriously declining on their breeding and wintering grounds.

The parks have suitable habitat for a number of small mammals whose range is confined to moist, dense, coniferous forests and associated coastal habitats in the Pacific Northwest. These include the marsh shrew (*Sorex bendirii*), shrew-mole (*Neurotrichus gibbsii*), coast mole (*Scapanus orarius*), mountain beaver (*Aplodontia rufa*), California red-backed vole (*Clethrionomys californicus*), red tree vole (*Arborimus longicaudus*), Townsend's vole (*Microtus townsendii*), and Pacific jumping mouse (*Zapus trinotatus*). These species have been recorded in all three state parks, except for the shrew, red tree vole, and Townsend's vole. The latter two species have been observed in

AFFECTED ENVIRONMENT

Jedediah Smith Redwoods State Park. There are records of the shrew and the red tree vole from Del Norte Coast Redwoods State Park from studies done in conjunction with the realignment of the highway at Cushing Creek.

In addition to species confined to the moist coastal habitats, other small mammals include several species of deermice (*Peromyscus* spp.), dusky-footed woodrat (*Neotoma fuscipes*), western harvest mouse (*Reithrodontomys megalotis*), little brown bat (*Myotis lucifugus*), Yuma myotis (*Myotis yumanensis*), California myotis (*Myotis californicus*), and Townsend's big-eared bat (*Plecotus townsendii*).

Species known to occur in the parks that are found in higher numbers in old-growth forest are Pacific giant salamanders (*Dicamptodon tenebrosus*), marbled murrelets (*Brachyramphus marmoratus*), and flying squirrels (*Glaucomys sabrinus*). The presence of these species can be used as an indicator of ecosystem health.

Large mammals that may be spotted by visitors are the gray fox, coyote, black bear, river otter, bobcat, mountain lion, black-tailed deer, Roosevelt elk, seals, and sea lions. Gray whales are also seen from ocean overlooks or from coastal beaches on their annual migrations between northern feeding grounds and calving areas off the coast of Baja California, Mexico.

Clearcutting of forests in the Coast Range has provided artificial clearings suitable for Roosevelt elk, black bear, and black-tailed deer. These cutover lands in and around the parks provide excellent habitat and resulted in an increase in numbers during the period of intensive logging. New plant growth is abundant on clear-cut forest lands, and it is more nutritious than older plant material. Use of second-growth forested areas by elk, deer, and black bear has declined relative to when these areas were first cut.

Currently in Humboldt and Del Norte Counties, elk appear to be expanding their range from population centers located on both private and public lands near Big Lagoon, along Prairie Creek, along the Gold Bluffs, in the lower Redwood Creek area, and in the Bald Hills (Rick

Wallen, RNSP fish and wildlife biologist, pers. comm., 12/12/97). Roosevelt elk are commonly seen in meadows and open pastures along Highway 101 near Orick and in Elk Prairie and along Gold Bluffs Beach in Prairie Creek Redwoods State Park. In 1984 there were four herds in that park, totaling about 200 animals. Elk have been noted recently in Jedediah Smith Redwoods State Park and vicinity.

The Gold Bluffs Beach herd uses beach dune areas and coastal spruce forests for cover, mating and calving areas, and forage. In the Bald Hills, the herd is associated with the prairies, especially in the spring and fall. Elk use of the nearby second-growth forest is greatest during the mating season in September and October. Habitat characteristics important to elk include forage areas, mating and calving grounds, travel corridors, resting areas, and escape cover.

The opportunity to see elk is one of the main attractions of the parks. Elk Prairie in Prairie Creek Redwoods State Park is well known for its elk herd. Their large size, impressive antlers, and habit of frequenting open pastures make Roosevelt elk the most prominent animal in the parks. Visitors driving through Prairie Creek Redwoods State Park (Newton B. Drury Scenic Parkway) or along Highway 101 near Davison Ranch often stop to watch or photograph the elk. There are no reports of elk seriously injuring humans, even though humans approach closely despite signs warning of potential danger from these wild animals.

There are historical reports of "bands of hundreds, perhaps thousands" of elk in the area in 1850-52. Elk were killed in great numbers in California for food and hides as settlement occurred after the Gold Rush of 1848. Conversion of elk habitat to croplands further reduced numbers. Elk persisted in coastal northwestern California where dense forest and brush and difficult access provided refuge. Humboldt County elk became abundant again a hundred years later, by 1964. In 1979 one researcher estimated the California Roosevelt elk population to be 1,000 to 1,300 with roughly half of those in and around the parks (Mandel and Kitchen 1979).

Present-day mortality of elk is due to poaching, accidental death (mostly by motor vehicles), and malnutrition. Predation and disease do not appear to be major factors. Occasional special hunts on adjacent nonpark lands are allowed by the California Department of Fish and Game for herd reductions. In five special hunts between 1964 and 1984, 300 permits were issued and 222 elk were taken. The burning of grasslands and prairies increases habitat favored by elk and increases the nutritional value of the forage.

There are probably more black bears in the region than when Euro-Americans first arrived in large numbers after the Gold Rush. This increase can be attributed to less competition with grizzly bears after their extirpation in the early 1920s and an increase of favorable habitat following extensive timber harvest in the region. Black bears are attracted to human foods and quickly learn to associate humans with food. The parks have an active bear management program that relies on educating park users about the importance of proper storage and disposal of food-related items and trash. The program also includes aversive conditioning of bears to humans and human food sources. Numerous human food sources such as garbage and gardens exist adjacent to the parks, making it difficult to keep the bears from learning to associate humans with food.

Mountain lions appear to be increasing in numbers in northern California and are being seen more frequently in the parks over the past few years. Some reported encounters with mountain lions have been unusual in that the lions did not flee immediately at the sight of humans. Such reports trigger close monitoring by RNSP staff to protect public safety. If necessary, trails may be temporarily closed to minimize human/lion contact.

RARE, THREATENED, AND ENDANGERED SPECIES

Threatened, endangered, candidate, rare, and sensitive plants and animals that are known to inhabit the parks or for which suitable habitat

exists are presented in appendix I. All listed terrestrial species in the parks are birds.

Threatened and Endangered Plants

No federal or state listed, proposed, or candidate threatened or endangered plant species have been confirmed in Redwood National and State Parks. No systematic surveys of the parks specifically for these or other sensitive plant species have been done; surveys for rare or sensitive plants are incidental to resource management or development projects, or are done when RNSP staff receive reports of such species. RNSP botanists are investigating reports from summer 1999 that a few individuals of two federally listed plant species have been discovered. One report places the Western lily (*Lilium occidentale*) a federally listed threatened species, in the northern part of the park. RNSP staff also investigated a possible occurrence of beach layia (*Layia carnosa*), a federal and state listed endangered plant, at Freshwater Lagoon Spit. RNSP staff have not been able to confirm the presence of either species because the plants had finished blooming when park staff looked for them. RNSP botanists will conduct surveys of likely habitat for both these species at the next possible opportunity. There are no records of specimens of western lily from the parks. The closest documented western lily population is north of Crescent City. Potential habitat for western lily in the parks includes coastal scrub and coastal prairie vegetation types. Lilies have not been encountered during surveys in conjunction with projects at Enderts Beach; Deer Meadow; DeMartin, Lincoln, and Ossagon Prairies or a small prairie just north of the mouth of Redwood Creek.

Threatened and Endangered Wildlife

Two birds associated with old-growth forest, the northern spotted owl and the marbled murrelet, are the most prominent listed species in the parks. The location and timing of RNSP operations, including maintenance and development of trails, roads, and facilities and activities

that alter suitable habitats, are managed to protect all listed species by limiting some actions during respective breeding seasons. Limitations include time of day restrictions for the use of power tools or the use of hand tools to keep noise below ambient level for each location. In some cases, maintenance or development operations are implemented only during the nonbreeding season for each species. A conservation strategy for all listed species has been developed to manage RNSP operations in a manner that balances potential adverse impacts on listed species and minimizes human disturbance of habitats occupied by listed species.

Northern Spotted Owl
(Strix occidentalis caurina)

Spotted owls are typically found in old-growth forests in the parks (Tanner and Gutierrez 1996). Second-growth forest older than 40 years and forest stands as small as 1 acre (or less with remnant old-growth trees) are considered suitable spotted owl habitat. Dense, open-canopied forest stands, with associated snags and large down log habitat components, provide the primary nesting and foraging habitat to ensure successful reproduction. The dusky-footed woodrat is the primary prey species for the spotted owl in northwestern California (Solis 1983; Ward 1990).

Suitable spotted owl habitat is defined as mature forest stands that have multilayered conditions, a canopy closure of at least 70% or greater, and obvious decadence (Forsman et al. 1984; LaHaye 1988). The overstory should contain trees that are 21 inches or greater diameter at breast height (dbh) and should comprise at least 40% of the total canopy closure. In inland forests adjacent to the parks, some stands with less than 40% overstory canopy closure are also considered suitable owl habitat. These stands typically have a hardwood understory, which increases the total canopy closure to 60% or greater. Suitable habitat should contain numerous large snags, groundcover characterized by large accumulations of logs or other woody debris, and a canopy open enough to allow owls to fly within and beneath it.

In Redwood National and State Parks, vegetation analysis indicates that there are 55,000 acres of habitat suitable for roosting, foraging, and nesting for spotted owls. This includes all old-growth and uncut forests and second-growth forests that were cut more than 40 years ago. Another 37,000 acres may be suitable foraging habitat.

There is no designated critical habitat for the northern spotted owl in the parks.

Thirty-nine northern spotted owl activity centers have been located in Redwood National and State Parks since 1993. An activity center may be occupied by a pair or a single owl. An average of 24 activity centers have been known to be occupied (annually). RNSP monitoring programs have noted that 14 activity centers have successfully fledged young since 1993. Six (42%) of these territories have fledged young more than one year (Childers et al. 1999).

Marbled Murrelet
(Brachyramphus marmoratus marmoratus)

Marbled murrelets range from Alaska south to central California. These robin-sized birds feed on fish in ocean waters within 1 mile of shore, returning to inland roosting and nesting sites in the early morning and evening. Known nest sites are in mixed stands of mature and old-growth coniferous forests within 35 to 50 miles of the ocean (Hamer and Nelson 1995). Suitable nesting habitat consists of mature and old-growth forest with nesting platforms and adequate canopy cover surrounding the nest site. Most of the known population in California (57%–60%) occurs in near-shore habitats off the coast from Redwood National and State Parks (Ralph and Miller 1995).

Murrelet nests are difficult to locate because most nests are high in the canopy, birds are camouflaged by their coloring, adults are often quiet in the vicinity of nests, and adults may only move once a day during low light conditions (Paton 1995 and USFWS 1996a). Instead, identification of occupied sites and suitable nesting habitat are the best indicators of potential nest sites. Indicators of occupied habitat include

active nests; egg shell fragments; young found on the forest floor; marbled murrelets seen flying through the forest beneath the canopy, landing in trees, circling above the canopy, and calling from a stationary perch; or large numbers of murrelets heard calling from in and around a forest stand (Paton 1995; USFWS 1996a). Observed "occupied behavior" is used as a substitute for direct observations of murrelet nesting. Occupied behavior is a specific pattern of flight that is considered by the marbled murrelet technical committee of the Pacific Seabird Group to indicate the use of a stand of trees for nesting by marbled murrelets (USFWS 1996a).

The three state parks in Redwood National and State Parks contain designated critical habitat for marbled murrelets. The primary constituent elements of critical habitat are defined as

individual trees with potential nest platforms and forest lands of at least one half site-potential tree height regardless of contiguity within 0.8 kilometers (0.5 miles) of individual trees with potential nesting platforms and that are used or potentially used by marbled murrelets for nesting or roosting. (USFWS 1996a)

Habitat characteristics associated with murrelet nesting are large trees with lateral branches at least 4 inches in diameter, which provide nesting platforms, and a mature understory that extends into the canopy of the old growth, which provides protection for potential nest sites. Forest stands containing trees greater than 32 inches in diameter may be considered suitable nesting habitat. Trees must have large branches or deformities for nest platforms, with the occurrence of suitable platforms being more important than tree size alone (USFWS 1996a). Douglas-fir, coastal redwood, western hemlock, and Sitka spruce are the trees most likely to provide suitable nesting structure (Hamer and Nelson 1995)

Nesting habitat includes the forest stand in which the nest trees are contained. Nest stands are defined as contiguous mature and old-growth forest with no separations greater than 100 meters (330 feet) wide. Although stands of old-growth trees

larger than 500 acres are more likely to be occupied by murrelets, birds have been detected in smaller stands in the parks (Miller and Ralph 1995; Carolyn Meyer, University of Wyoming, pers. comm., August 1997).

Analysis of the vegetation in the parks indicates that old-growth forest and other suitable nesting habitat for marbled murrelets totals about 43,000 acres. Second-growth forest currently without the habitat elements critical for nesting totals 45,000–50,000 acres; this is potential future nesting habitat.

Marbled murrelet detections in the parks have been made in the Tall Trees area (24 observations), within the Lady Bird Johnson grove (14), Lost Man Creek area (26), and the old-growth forests throughout Prairie Creek Redwoods State Park (120) (Howard Sakai, RNSP supervisory ecologist, pers. comm. 2/24/97). Because of the difficulty of locating marbled murrelet nests, any forest stand that contains trees with characteristics suitable for murrelet nesting is assumed to be occupied by murrelets.

The probability of predation at nest sites increases with habitat modification (Divorky and Horton 1995). Potential predators include raccoons, great horned owls, ravens, crows, Steller's jays, and peregrine falcons, all of which are known to occur in the parks. Nesting failures of 23 nests have been documented from predation (61%), chicks falling from nests, and human disturbance (Nelson and Hamer 1995).

Humans in old-growth forests could create noise that may disturb nesting murrelets. If an adult leaves a nest, an unprotected chick is at risk of being preyed upon. Humans may also bring in food or litter that attracts corvid bird species (ravens, crows, and jays). Ravens and jays prey on murrelet nestlings and eggs (Nelson and Hamer 1995). These and other predators such as raccoons, owls, and gulls, are known to use human-made corridors such as roads for access into dense forests and to frequent areas that are heavily used by humans, such as campgrounds and picnic areas (Nelson and Hamer 1995). Results of inventories of corvid species throughout old-growth forest habitats indicate

that Steller's jays are more abundant than common ravens (Wallen et al. 1999). Steller's jays are significantly more abundant in areas surrounding campgrounds and picnic areas than in the old-growth forest habitats away from these developments.

Brown Pelican (*Pelecanus occidentalis*)

Pelicans are commonly seen flying over the Pacific shoreline. The brown pelican hunts fish that are swimming near the surface, but it will also hunt in the larger lagoons and estuaries. Although brown pelicans are not known to nest in the parks, analysis of potential habitat indicates that there are about 1,600 acres of suitable roosting and foraging habitat in the parks. The closest breeding colony is on Anacapa Island off the southern California coast.

**Western Snowy Plover
(*Charadrius alexandrinus nivosus*)**

The sandy beaches and coastal dunes throughout the parks are potential nesting habitat for snowy plovers. No nesting plovers have been found following three summer and two winter surveys (Steinberg 1995, Falvey 1998). Historically, the species is known to have nested at the Stone Lagoon and Big Lagoon Beaches, a few miles south of Freshwater Lagoon Spit (Page and Stenzel 1981).

Plover populations in the region are thought to have declined because of increased human use of beaches (Page et al. 1995). Plovers foraging at Gold Bluffs have been killed by off-highway vehicle traffic (Gary Strachan, State Park Ranger, pers. comm. 1995). Moving Highway 101 onto Freshwater Lagoon Spit in the late 1950s probably contributed to the decline of potential nesting populations in the parks (Rick Wallen, RNSP fish and wildlife ecologist, pers. comm. 8/19/97).

American Peregrine Falcon (*Falco peregrinum anatum*)

The peregrine falcon was removed from the federal list of endangered species on August 25,

1999 (USFWS 1999). The falcon is listed as endangered by the state of California. Peregrine falcons typically nest on ledges on cliffs and nearly vertical rocky outcrops. The steep coastal bluffs are potential nesting habitat for peregrine falcons. They feed primarily on birds and prefer foraging in riparian forest habitat and along coastal bluffs.

The parks' wildlife observation database records about four sightings annually from the early 1980s to the mid-1990s. The number of peregrine nest sites in northern California has steadily increased during the last 10 years. The observed behavior and regular sightings of falcons suggest that they are nesting in the region. Two eyrie sites are known in the parks.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles feed primarily on fish and waterfowl, but also forage on carrion. Bald eagles are most commonly observed at the mouths of Redwood Creek and the Klamath River, at Freshwater Lagoon, and at coastal areas and prairies. Most observations in the parks are during the winter and are likely northern birds that have migrated south to find food where rivers, streams, and lakes are not frozen or covered with snow. A pair of bald eagles nested and successfully fledged two young in the park near the mouth of Redwood Creek during summer 1999. Nesting usually occurs near lakes, streams, and rivers in large old trees in open, uneven-aged mature or old-growth forests. Bald eagles typically roost in snags and dead branches in groups of several individuals.

Noise in Relation to Threatened and Endangered Wildlife

Noise has been identified as a source of disturbance and thus a potential threat to some listed threatened and endangered species, particularly to northern spotted owls and marbled murrelets during their respective breeding seasons (USFWS 1997; Carolyn Meyer, RNSP supervisory ecologist, internal memorandum, March 2, 1994).

Background noise in the interior of the parks is generally much lower than that expected or tolerated in developed areas in which the federal noise guidelines are generally applied. Very limited measurements of noise have been taken to estimate the noise generated by trail maintenance activities in old-growth habitat. Background noise measured by staff biologists and maintenance staff in the forest ranged from 45 to 60 dBA. Chainsaws were measured at 100 dBA at 10 feet away; 82 dBA at 100 feet; and 44 dBA at 500 feet (Redwood National Park memorandum to U.S. Fish and Wildlife Service, 6/23/93). These were instantaneous measurements, rather than L_{10} or L_{eq} (see appendix J for definitions).

Sources of noise in Redwood National and State Parks and the vicinity include local communities and their commercial and residential areas; legal use of firearms on adjacent private lands and illegal poaching; highway traffic, especially brakes on large trucks; aircraft; powerboats on Freshwater Lagoon and in the Klamath River estuary; heavy industry such as timber harvest operations on adjacent private lands; construction and maintenance activities in the parks and on adjacent private land; humans using roads, trails, campgrounds, and other facilities in and adjacent to the parks; humans off trails and roads; wildlife such as elk bugling and birds calling; wind, rain, and thunder; and the sounds of the ocean, rivers, and streams.

RNSP operations generate noise from personnel; vehicles; large and small generators; hand tools such as hammers and power saws; heavy equipment such as backhoes, tractors, mowers, and bulldozers; and smaller power equipment such as chain saws, wood chippers, cement mixers, generators, and weed eaters. Noise from RNSP operations above ambient levels is generally confined to the daylight hours, with the longest work hours in summer between 7 A.M. and 6 P.M.

Concentrated human activity generates noise primarily during daylight hours in park areas including the two outdoor schools, campgrounds, picnic areas, trailheads, visitor centers, housing, and maintenance areas. Noise from the campgrounds and the outdoor schools above

ambient levels may be produced between 6 A.M. and 10 P.M.

Qualitative determinations of noise levels can be made for several locations and noise sources throughout the parks. Baseline, or ambient, levels of noise are highest in intensity and most frequent or of long duration in the Highway 101, 199, 197, Howland Hill, and Bald Hills Road corridors; near Orick, Klamath, Requa, Crescent City, and Hiouchi; at industrial sites and developed areas in the parks; and near the ocean. High intensity but infrequent noises include storms, firearms, aircraft, and construction and maintenance activities that use heavy equipment, chainsaws, or other noise-producing tools. Storms are infrequent on an annual basis but may produce intense noise for short periods and be several days in duration.

Noises produced by visitors using trails or roads are low to moderate in intensity and of short duration for any given point, depending on how fast someone walks or drives. Spoken conversation is assumed to produce noise in the 45 to 60 dBA range. Noises from backcountry campsites are infrequent, low to moderate in intensity, and generally less than 24 hours in duration.

Threatened and Endangered Fish

One fish species, the tidewater goby, which inhabited the coastal estuaries in the parks as recently as 1980, is listed as endangered. Four species of fish in the salmon family (referred to as salmonids) that inhabit the parks are listed, proposed for listing, or candidate species for listing under the federal Endangered Species Act. The southern Oregon/northern California coastal coho salmon is federally listed as threatened. The southern Oregon/coastal California populations of chinook salmon are proposed for federal listing as threatened. Critical habitat for coho and chinook salmon that inhabit the parks has also been proposed for RNSP streams. The coastal cutthroat trout and the Northern California and Klamath Mountains Province populations of steelhead are federal candidate species for listing as threatened.

Tidewater Goby (Eucyclogobius newberryi)

This fish occurs in coastal estuaries that are tidally influenced. It was known from Freshwater Lagoon and the Redwood Creek estuary. Specimens were obtained from the Redwood Creek estuary in 1980. Since that time, no gobies have been encountered in surveys of the estuary done in conjunction with monitoring for juvenile salmonids. No systematic tidewater goby survey specifically targeting goby population abundance has ever been conducted in the parks. The northern populations of tidewater gobies have been proposed for delisting as endangered by the U.S. Fish and Wildlife Service (USFWS 1999b).

Salmonid Fishes

Four species of salmonids that inhabit the parks are important as sport or commercial fisheries: chinook and coho salmon and steelhead and coastal cutthroat trout.

These species are anadromous. Anadromous fish migrate as juveniles from freshwater to the ocean (after a few months to several years of freshwater rearing), grow to adulthood in the ocean in two to five years, and return to spawn in freshwater. The strong homing tendency of anadromous fish leads to the evolution of subpopulations of fish or "stocks" that are adapted to their native streams (Ricker 1972).

The salmon in the parks belong to the group known as Pacific salmon. Pacific salmon die after spawning. Unlike other Pacific salmon, steelhead may spawn more than once before they die. Pacific salmon are among the most important sport and commercial fishes in the world. The extremely high value of these fish as food and a yearly abundance as the fish move from the ocean into freshwater led to permanent human settlements in places where the food literally came to the people. The food value led to the development of complex commercial industries. The exploitation of the fish and the competition among Pacific nations caused the establishment of international, national, and regional commissions to regulate the fishery (Scott and Crossman 1973).

Different stocks of fish of the same species may migrate into freshwater at different seasons and in different stages of maturity. These stocks are commonly referred to by the season when they migrate into freshwater, e.g., summer and winter steelhead or spring-run and fall-run chinook. Fish stocks throughout the Pacific Northwest region are threatened by the cumulative impacts of livestock use, road construction, timber harvest, stream channelization, water diversions, hydroelectric development, overfishing, and the influence of hatchery fish on both disease resistance and genetic fitness of native stocks (U.S. Dept. of Commerce/NMFS 1997a and 1997b).

The numbers of anadromous fish are governed by conditions in both freshwater and marine environments. Three factors have the greatest potential to affect the quality and quantity of freshwater habitat: water temperature, fine sediment, and habitat complexity or cover. Good freshwater habitat for anadromous fish contains complex habitat with both wood and rock, spawning gravels with low levels of fine sediment, water temperatures rarely more than 60°F., shade cover, and a well-developed riparian zone (USFS 1995).

The major fish-producing rivers and streams in and upstream of the parks are the Smith River, its tributary Mill Creek (particularly the West Branch), the Klamath River, Redwood Creek, and its tributary Prairie Creek.

Only the mouth of the Klamath River is within the parks, and there is no suitable spawning habitat in this portion of the Klamath River. Fisheries in the Klamath are managed by the Yurok Tribe, the California Department of Fish and Game, the National Marine Fisheries Service, Klamath Fisheries Management Council. Chinook salmon and steelhead are major sport fisheries on the Klamath. Fall-run chinook at the mouth of the Klamath and steelhead in the winter are an important source of tourism income for the town of Klamath. Fifty percent of the Klamath anadromous fishery is allocated for Yurok Tribal member subsistence and commercial use.

During winter and spring, steelhead and chinook are major sport fisheries in the Smith River. The large size of Smith River salmon and steelhead gives the river national prominence among sportfishing enthusiasts. The California state record steelhead (more than 27 pounds) was caught in the Smith River.

Coho are widely distributed in the Smith River basin, with the most significant populations in Jedediah Smith Redwoods State Park. Only occasional spring-run chinook and summer steelhead are observed in the Smith River. Anadromous coastal cutthroat are widely distributed through the Smith River drainage, but they are not abundant (USFS 1995).

Mill Creek (in Del Norte Coast Redwoods State Park and Jedediah Smith Redwoods State Park) and Prairie Creek (in Prairie Creek Redwoods State Park) are important spawning grounds for chinook and coho salmon and steelhead and coastal cutthroat trout. The California Department of Fish and Game recently closed Prairie Creek to sportfishing to protect all trout spawning and rearing tributaries. When Prairie Creek was open to trout fishing in the past, the most likely fish caught were cutthroat trout and juvenile steelhead (David Anderson, RNSP fishery biologist, pers. comm., 1996-97).

Redwood Creek is used by chinook and coho salmon, steelhead, and coastal cutthroat trout. The lower third of the Redwood Creek watershed is within the national park, as is the mouth of Redwood Creek and a portion of its estuary. The estuary is a holding area for juvenile fish before they migrate from freshwater to the ocean. Young chinook salmon and some steelhead juveniles produced in the upstream reaches of the creek and the tributaries migrate downstream to the estuary in summer. Low summer river flows cause a sandbar to build that blocks the flow of the creek into the ocean. Chinook, steelhead, and sea-run cutthroat trout live in the estuary embayment where they feed on invertebrates and grow to a size that will enhance their chance for survival during the ocean stages of their life cycle. Juvenile fish migrate out to the ocean in the late fall or winter when the winter rains make the creek rise and

break through the sandbar. Artificial breaching of the sandbar in the summer causes the juvenile fish to enter the ocean at a smaller size, which may decrease the chances of survival for these fish.

Chinook (*Oncorhynchus tshawytscha*). Chinook salmon, the largest salmonid occurring in the parks' rivers and streams, spawn primarily in the larger streams, including the Smith River, the Klamath River, Redwood Creek, and the main stems of Mill Creek, Lost Man Creek, and Prairie Creek.

Chinook typically return from the ocean to rivers, larger streams, and larger tributaries to spawn between November and early January. Chinook return to the Klamath in August and September. In spring, chinook salmon fry (early life stage that develops from the egg) migrate downstream to rear in the Redwood Creek estuary before entering the ocean in the fall. Chinook salmon usually return to freshwater after three to four years in the ocean, although two-year-old male spawners are commonly observed.

Winter-run chinook constitute the main chinook runs in RNSP streams. These fish arrive around November and have spawned and died by January. Adult spring-run chinook were observed in only one season since 1981 when the NPS staff began surveys. Spring-run chinook do not typically use Redwood Creek.

On March 9, 1998, the National Marine Fisheries Service proposed to designate critical habitat for the southern Oregon/California coastal populations of chinook salmon. Critical habitat within the parks consist of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches of RNSP streams accessible to chinook. Accessible reaches are those within the historical range of the populations that can still be occupied by any life stage of chinook salmon. There are no sections of streams within the parks that are inaccessible because of specific dams identified in the NMFS proposal or because of long-standing, naturally impassible barriers such as natural waterfalls in existence for at least several hundred years. Adjacent riparian zones are

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defined as those areas within a horizontal distance of 300 feet (600 feet when both sides of the channel are included) from the normal line of high water of a stream channel or adjacent off-channel habitats.

Coho Salmon (*Oncorhynchus kisutch*). Coho salmon, smaller than the chinook, spawn in the Smith River, the main stem of Mill Creek, Redwood Creek, Prairie Creek, and some of the smaller tributaries of these creeks.

Coho salmon have a simple (relative to other anadromous Pacific salmon) three-year life cycle. Adult coho return to freshwater between November and early February to spawn.

Coho use a variety of spawning sites but characteristically enter small coastal creeks or tributary headwaters of larger rivers to spawn. The tiny fry occupy shallow stream edges next to pools but move into deeper water as they grow. Coho salmon juveniles remain in the streams for one year before migrating to the ocean, typically between March and May. Most coho salmon return to freshwater after two years in the ocean.

Optimal rearing habitat for juveniles is pools deeper than 3.5 feet (1 m) that contain logs, large tree roots, or boulders in heavily shaded sections of the streams.

On November 25, 1997 (U.S. Department of Commerce/NMFS 1997), the National Marine Fisheries Service proposed to designate critical habitat for the southern Oregon/northern California coastal populations of coho salmon. Proposed critical habitat includes all waterways, substrate, and adjacent riparian zones of estuarine and riverine sections accessible to coho salmon. Accessible sections are those within the historical range of the fish populations that can still be occupied by any life stage of coho salmon. There are no sections of streams within the parks that are inaccessible because of specific dams identified in the NMFS proposal or because of longstanding, naturally impassible barriers such as natural waterfalls in existence for at least several hundred years. Adjacent riparian zones are defined as those areas within a horizontal distance of 300 feet (600 feet when

both sides of the channel are included) from the normal line of high water of a stream channel or adjacent off-channel habitats.

Steelhead (*Oncorhynchus mykiss*). Steelhead are the last of the salmonid species to return to freshwater in the annual cycle, generally between January and April. Steelhead juveniles rear in the streams for one to four years before their migration to the ocean. They then reside in marine waters for typically two or three years before returning to freshwater to spawn. Unlike other Pacific salmon, steelhead are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females, provided there are no barriers to migration and adequate amounts of water are left in the stream during the dry summer months.

Steelhead can be divided into two reproductive types, based on their state of sexual maturity at the time of river entry and the duration of their spawning migration. These two types are termed "stream maturing" and "ocean maturing."

Stream-maturing steelhead enter freshwater in a sexually immature condition and require several months to mature, after which they spawn. Stream-maturing steelhead are also known as summer steelhead. Ocean maturing (or winter) steelhead enter freshwater in a mature state and spawn shortly after river entry. Summer steelhead return to a river or stream from spring to early fall and remain in deep pools until spawning occurs. The long freshwater holding time renders the adult steelhead especially vulnerable to predation and habitat changes.

On March 19, 1998, NMFS published its determination that the Klamath Mountains Province and Northern California populations of steelhead do not warrant listing as threatened species at this time. NMFS determined that these populations do warrant classification as candidate species. The status of these fish will be reevaluated within four years to determine whether they should be listed. The candidate species include steelhead populations occurring in coastal streams between Cape Blanco, Oregon, and the Klamath River basin in Oregon and California, inclusive (Klamath Mountains Province), and

populations occupying coastal river basins from Redwood Creek in Humboldt County south to the Gualala River in Mendocino County, California, inclusive.

Both large rivers and small streams in the coastal region may have suitable habitat for steelhead, but not all small streams can support steelhead. One type of coastal stream is the small, generally intermittent headwater streams at the northern end of Prairie Creek Redwoods State Park that are tributaries to the Klamath. These are unsuitable for steelhead because of inadequate flows and the lack of suitable spawning habitat. Another type of coastal stream are small streams that enter the ocean directly, rather than as a tributary of a larger river or creek. These streams have a limited potential for salmonid production because of small size, inadequate flows, and the lack of suitable spawning habitat. However, the lowermost reaches of Cushing Creek and Nickel Creek to the north have a small amount of suitable spawning habitat for steelhead and may be used in wet years.

Redwood Creek has both summer and winter runs of steelhead. The summer run has declined since surveys began in 1981. The most summer steelhead seen during NPS summer surveys of portions of the main stem of Redwood Creek is 44 fish. Few fish were seen in the mid-1990s. No other streams within the parks in the Redwood Creek basin have been surveyed because these streams do not have large enough pools to support adult fish during the warm summer months.

Coastal Cutthroat Trout (*Oncorhynchus clarki*). Coastal cutthroat trout are native to northwestern California, occurring northward from the Eel River drainage, about 50 miles south of the Redwood Creek. Cutthroat inhabit most coastal streams, especially in the Prairie Creek drainage, Espa Lagoon, the streams that drain into the ocean along Gold Bluffs Beach, and Mill Creek.

Adult anadromous cutthroat return to freshwater in late autumn and early winter and spawn in small streams between February and May. Cutthroat trout are often found in the summer in the Redwood Creek estuary. RNSP fisheries staff

suspect that a few resident, nonmigratory populations of cutthroat trout inhabit the tributaries of Redwood Creek.

Coastal cutthroat occur in the same waters as rainbow trout, but they generally spend more time in smaller tributaries and headwater reaches. Cutthroat compete with rainbow trout where the two species live together. Rainbow trout are a resident form of steelhead.

The lowermost reaches of Cushing Creek and Nickel Creek, which drain directly into the ocean in the northern part of the national park, have resident and perhaps anadromous populations of coastal cutthroat trout.

Other Threatened and Endangered Wildlife Species

The Oregon silverspot butterfly (*Speyeria erene hippolyta*), a federally listed threatened species that occupies coastal scrub, is not known to occur in Redwood National and State Parks. The closest known population occurs near Lakes Earl and Talawa about 3 miles west of Jedediah Smith Redwoods State Park.

Four species of sea turtles known from the north Pacific Ocean are federally listed as threatened or endangered (green sea turtle, *Chelonia mydas*; loggerhead sea turtle, *Caretta caretta*; olive ridley sea turtle, *Lepidochelys olivacea*; and leatherback sea turtle, *Dermochelys coriacea*). Sea turtles typically are more common in warmer oceans. The coastal area of the parks is too cold for breeding for these species. No breeding beaches have been documented in California. These turtles do occur occasionally in offshore waters, as strandings have been noted by marine mammal rescue groups, but any animals found on the beaches are either sick or injured. Consequently, turtles are considered transients, and no important habitat features exist in the parks that are crucial to the turtles.

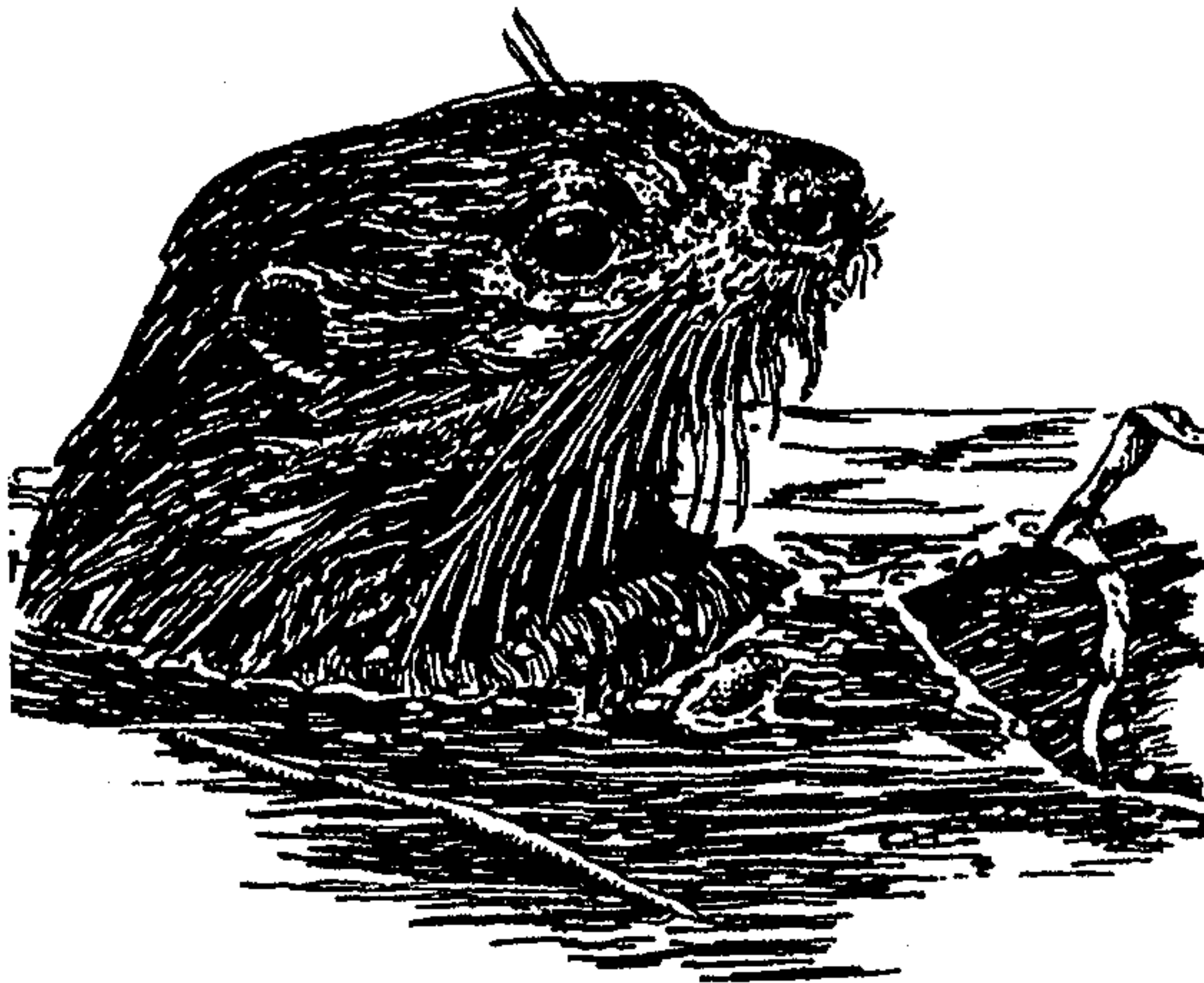
Redwood National and State Parks are within the range of the Aleutian Canada goose (*Branta canadensis*), federally listed as threatened. These birds forage on flat areas such as low-elevation

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riverbottoms and agricultural pastures. Aleutian Canada geese are known to forage at the Smith River riverbottoms a few miles northwest of the Jedediah Smith Redwoods State Park and at Patrick's Point State Park about 15 miles south of the mouth of Redwood Creek. Undoubtedly they use the coastline as a flyway. No observations have been recorded for RNSP lands.

The northern (Steller) sea lion (*Eumetopias jubatus*) is federally listed as threatened. Steller sea lions do not habitually enter bays, estuaries, or river mouths. They inhabit the outer coast, resting on flat offshore rocks and rocky islands.

These sea lions have been observed occasionally at the mouth of the Klamath River as they migrate along coastal waters. Northern sea lions use large, flat surface rocks for breeding. The offshore rocks within the RNSP coastline are too steep to be suitable for breeding. The closest breeding colony is at Cape Mendocino, about 100 miles south of the parks.



CULTURAL RESOURCES

BRIEF HISTORICAL OVERVIEW OF THE REGION

Pre-European Settlement

During the pre-European settlement period, lands, streams, and coastal areas throughout the parks were important hunting and gathering areas for American Indians. The archeological patterns for pre-European cultural resources within Redwood National and State Parks represent adaptations shared by a number of separate cultures over a long time and a broad area. From 4,500 B.P. (before the present) to 2,800 B.P., the cultural practices in the vicinity of Redwood National and State Parks are thought to have involved the hunting and gathering of deer, elk, acorns, and other edible seeds by small, highly mobile family groups. Artifacts found in the parks imply that these groups often had base camps along high ridgetops, between which people moved as various resources became seasonally available. There is little or no evidence that the groups developed extensive trade networks.

From 2,800 B.P. to 1,100 B.P., increased migration into the area either conveyed or enabled the development of new technology to store food, particularly fish and acorns for the lean winter months. Villages were established as populations increased and food supplies stabilized. The people generally lived in low-elevation villages situated along salmon-bearing streams or near acorn crops, although some sites reflect more specialized activities. The development of the mortar and pestle, which were used to grind acorns, also occurred at this time, and projectile point forms notably diversified.

The Yurok, Tolowa, and Chilula

From 1,000 B.P. to the time of European contact during the early 19th century, the Yurok, Tolowa, and Chilula, among others, adapted to the coastal zone and lower waterways of north-west California. Due to the region's rugged

terrain and dense forests, the Tolowa, Yurok, and Chilula principally settled along the coast, coastal lagoons, rivers or creeks, and prominent ridgelines. Major villages were characterized as places occupied by relatively large groups of people, where important ceremonies were held and where the wealthiest men often lived. Subsidiary villages, or hamlets, were often in the vicinity. Both types of habitation were occupied by the bulk of the population for the majority of the year. Temporary campsites were occupied seasonally by smaller groups for special activities, such as acorn harvesting or smelt fishing.

Both the range of resources used and the subsistence technology were diverse. While fishing was emphasized in the traditional economy, collecting shellfish, hunting sea and land animals, and gathering floral products, especially acorns, were also important subsistence activities. Although the abundance and diversity of resources available enabled these Indian groups to reach high population density and cultural complexity, the seasonal availability and cyclical productivity of these resources brought times of privation or outright starvation, particularly during the late winter months when stored surplus foods were in short supply. The techniques used to store surplus foods included smoking or sun-drying fish; steaming and drying clams; storing dried acorns, nuts, seeds, berries, and seaweed in baskets or wooden boxes; and rendering the oil from sea mammals and certain fishes.

Two types of semisubterranean structures characterized the Tolowa, Yurok, and Chilula villages: common houses and sweathouses. Both types were constructed of redwood planks from felled logs, split by antler wedges and stone mauls and cross-cut with fire. The plank houses featured gabled roofs consisting of either two or three pitches. Circular or square doorways were cut into one of the end-wall planks near the ground, often entering onto an interior excavated porch area lined with flat slabs. A large, rectangular sunken pit for living activities was centered within the house, while the elevated perimeter was used for storage. Sleeping areas



Traditional Yurok dwelling made from split redwood logs. NPS photo.

were furnished with mattresses of deer, elk, or mountain lion skins or woven mats. In addition, the Chilula constructed brush-covered summer houses at the temporary summer camps and used hollow redwood trees as shelters during inclement weather.

Sweathouses were used strictly by men for social, medicinal, and ritual sweating, and they also served as dormitories for men and older boys. The structures were located near streams, lakes, or the ocean so that the men could plunge into cold water after sweating. The sweathouses were typically rectangular or square in shape, and featured a gabled or single-pitched shed roof covered with a mantle of earth.

Basketry played an important role in the lives of north coast Indians — from the cradle basket used at birth, to baskets designed for dipping, cooking, storing water and other items, fishing, grinding acorns, and carrying burdens, to items of personal adornment, such as basket caps used by women and those used in ceremonies. Yurok, Tolowa, and Chilula women practiced the twining technique, bringing the craft of basket weaving to a high degree of excellence. In

addition to basketry, the Indians of northwest California also crafted more than 200 distinct types of utensils from wood, stone, bone, horn, and antler, and they constructed canoes from redwood logs.

Like all California Indians, the north coast groups had a rich belief system that recognized countless spiritual entities. The Yurok, Tolowa, and Chilula participated in the World Renewal Cult, a ceremonial system whose purpose was to reestablish the positive relationship between humans and the earth. The ceremonies consisted of rites performed by a spiritual leader, along with the White Deerskin and Jump Dances. The dance locations depended on tradition and the availability of religious structures. In addition to these, the Brush Dance was held for the purpose of healing children.

Unlike many other North American Indians, however, the Indians of northwest California were not organized in large tribes with chiefs. Indian villages were connected through trading and exchange partnerships, as well as through social patterns related to kinship and marriage. Within each village were headsmen, whose

authority and prestige were based upon the possession and display of wealth. Even today, the Indians have strong ties to the villages of their ancestors and certain geographic places.

European Exploration and Settlement

The English explorer Francis Drake may have been the first European to sight the Humboldt coast in 1579, but landfall by this expedition is unlikely. Several Spanish sea expeditions later entered various rivers and harbors in the vicinity, and in 1775 Juan Francisco de la Bodega y Quadra erected a cross on Trinidad Head to commemorate the Spanish claim to this port. Later, trade in sea otter furs attracted American, Russian, and British ships to the north coast. American sea expeditions first anchored in Trinidad Bay in 1804 and 1805 and returned in 1806 to chart Humboldt Bay. The first overland party to penetrate the mountains of interior northwest California was led by Jedediah Smith, who traversed what is now the parks in the spring of 1828, reaching the coast near Crescent City before turning northward.

Although the early sea and overland explorers had little impact on the Indians of northwest California, the 1848 discovery of gold by Major Pierson B. Redding in the upper Trinity River area triggered a mass immigration of American miners and traders into the area in the early 1850s. A party led by Josiah Gregg explored Trinidad Head and Big Lagoon and then turned southward, finding Humboldt Bay. Word soon reached San Francisco that a large bay and river (the Klamath) lay west of the Trinity diggings, and investors funded expeditions that established supply ports at what are now Eureka, Arcata, and Crescent City. With the establishment of coastal towns, farmers and ranchers were also drawn to the north coast, first settling in the rich bottomlands near the population centers. Later they, too, settled in remoter areas where displaced Indian groups once sought refuge.

Indian groups found that access to their traditional food resources was curtailed as they were displaced by Euro-Americans, and their popula-

tions declined due to disease, starvation, and outright conflict. After many efforts to develop treaties satisfactory to both sides, as well as several incidents of violence, the Indian agent proposed the Klamath River Reservation along the lower 20 miles of the river (a portion of which now lies within Redwood National and State Parks). The reservation was established in 1855, through executive order of President Franklin Pierce.

Two years later, a military post, Fort Ter-Waw, was built near the Indian Agency. Severe flooding on the Klamath in the winter of 1861-62 led to the closing of the fort and the virtual abandonment of the reservation. A new reservation site was selected north of Crescent City. Numerous Tolowa were concentrated here, along with members of tribes from the Mad and Eel Rivers. To pacify Crescent City residents who objected to the reservation, a military post, Camp Lincoln, was established. Part of this military site is within Jedediah Smith Redwoods State Park.

In the late 1860s and 1870s a number of Americans took up residency on the Klamath River Reservation, but they were evicted in 1879. In 1891 President Harrison enlarged the nearby Hoopa Valley Indian Reservation to include lands along the Klamath River to 1 mile on either side, from just upriver of Weitchpec to the Pacific Ocean, thus encompassing the Klamath River Reservation. In 1892 the U.S. Congress enacted legislation both to open the Klamath River Reservation for homesteading by non-Indians and to award allotments to Yurok living along the river. As a result of this action, the majority of lands along the Klamath River are currently owned by non-Indians.

Commerce and Industry during the 19th Century

The packing and freighting of supplies to mines along the Trinity and the Klamath Rivers were among the first regional industries to develop, and they remained important economic activities throughout the 19th century. Several of the early pack trails, often following old Indian trails,

passed through present-day Redwood National and State Parks. Initially, merchandise was transported by packtrains of 20 to 30 mules that carried about 2.5 tons of goods. Freighting with large, specially built wagons pulled by 10-horse teams replaced packing by 1858. Gradually, the trip was made easier by the extension of farms and ranches along the inland routes, some of which provided lodging and meals for the freighters during their trips

In 1850 an exploratory group en route to the mouth of the Klamath River discovered glittering particles of beach sand, which proved to be gold. As word of the discovery spread, several San Francisco based mining companies quickly chartered vessels to transport prospectors to the area. Miners worked the beach sands by traversing them with mules at low tide, shoveling the gold-specked sands exposed by the surf into panniers. The panniers were then packed to sluice boxes, on higher and drier ground, where the gold specks were separated from the black and gray sands. By 1872 John G. Chapman had taken up residency on nearby Major Creek, on land now within the parks. Chapman served as superintendent of the San Francisco owned Union Gold Bluff Placer Mine until the company's disbandment in 1902. Using a local workforce that included Indians, the mine showed a profit during the late 1870s and early 1880s, but fared poorly thereafter due to the labor associated with separating the gold from the sands.

The first commercial fishery in the vicinity was established at the mouth of the Klamath in 1876 by two non-Indians. Protesting their presence, the Yurok lobbied successfully to have them evicted in 1879 from the Klamath River Reservation lands. In the late 1880s several commercial fisheries were established by Euro-Americans along and near the lower Klamath, employing many Yurok on a seasonal basis and using nets in the river to catch up to 10,000 salmon daily. In 1934 commercial fishing was declared illegal on the Klamath, following arguments that the fishery was being depleted by commercial activities. No remnants of fish canneries remain in the parks.

The dairy industry was also important along the north coast during the 19th century, but the timber industry was the region's most important historic enterprise, representing the shift from an era of relative self-sufficiency to an era of dependency as California's commerce became more economically dependent on the outside world. In the late 1880s Del Norte County's Hobbs, Wall Company produced raw materials for manufacturing boxes, which were transported within the western United States and internationally. As mining declined, freighting became more closely tied to the lumber industry until, in the 1880s and 90s, the freighting was supplanted by short-line railroads, which were built to transport logs from the logging camps to the mills. No longer dependent upon natural waterways to float logs downstream, loggers were able to open vast new areas for cutting. By the 20th century, Hobbs, Wall Company owned tens of thousands of acres of timberlands and employed several hundred workers.

The 20th Century

During the 20th century, tourism began contributing to the economic base of the north coast region. Until the Old Redwood Highway was completed in 1923, visitors traveled primarily by sea and were at the mercy of occasionally severe storms. After the Old Redwood Highway was constructed, the California Highway Commission supported preserving the old-growth redwoods within the right-of-way, a practice atypical of the times. Construction of this highway also coincided with the establishment of the Save-the-Redwoods League, founded in 1918 by conservationists dedicated to the establishment of tree preserves. In 1923 land acquisition began for Prairie Creek, Jedediah Smith, and Del Norte Coast Redwoods State Parks.

In the 1930s the Civilian Conservation Corps (CCC), which was created to alleviate unemployment during the Great Depression, made important contributions to the development of California state parks. Beginning in 1934, Prairie Creek Redwoods State Park served as home for the approximately 190 men of CCC

Company 1903. The company was housed in temporary buildings constructed in Boyes Prairie. Company 1903 undertook a number of projects in the parks, such as removing debris left from constructing Redwood Highway, opening side trails off the highway, and reducing fire hazards. As in many other parks across the country, the CCC also provided facilities for visitors: campgrounds, outdoor theaters, and buildings and bridges made of stone and other native materials.

During World War II, Japanese submarines cruised the coast of what is now Redwood National and State Parks, torpedoing a petroleum tanker that drifted aground near the entrance to Crescent City harbor on December 25, 1941. A submarine-based reconnaissance plane dropped an incendiary bomb near Brookings, Oregon, in September 1942, and the submarine itself sank two tankers off the coast of southern Oregon in October. As a result of these incidents, as well as the Japanese occupation of the western Aleutian Islands in June 1942, beach patrols and other coastal defenses were established along the U.S. Pacific Coast.

To patrol the beaches north and south of the Klamath, the Coast Guard developed a camp on the bluffs 2 miles south of the Klamath River. An observation station was built of cinder blocks, with wood siding, shake roofs, and false dormers. From the air or road, the buildings looked like a barn and farmhouse. Later, during the Cold War era, a radar station was established on the cliffs north of the Klamath. The latter station is now used for park maintenance operations, as well as a California Conservation Corps camp.

Although California had taken the lead in conserving the redwoods and had established, by the 1930s, the nucleus of the present-day north coast parks, there was also continuing interest in creating a national redwood park. Four decades later, in 1963, the National Geographic Society provided a grant to the National Park Service to finance a special study of California coastal redwoods. As a result, the "Tall Trees Grove" was discovered on private land near Orick. Five years later Redwood National Park was estab-

lished by an act of Congress; the park was further expanded in 1978, but the three state parks were kept separate from the national park. Now, working in partnership, state and federal agencies are developing a seamless approach to managing these important resources. Today, Redwood National and State Parks continue the efforts to preserve and restore the redwood forests first begun nearly a century ago.

PREHISTORIC RESOURCES

To date, about 30,000 acres (almost 30%) of Redwood National and State Parks lands have been surveyed for archeological resources. The parks' prehistoric resources are generally significant for their potential to yield information on research questions concerning changes in settlement and subsistence patterns through time and the development of local and regional chronologies, as well as the formulation of archeological survey methodology. In addition, certain prehistoric resources, e.g., trails, sites of ceremonial and sacred sites, and gathering and village sites, have associational significance for contemporary Indian peoples who have traditional ties to RNSP lands. Many of the parks' prehistoric sites have been previously impacted by logging, road construction, homesteading or ranching. Soil erosion has further disturbed many of the sites, making cultural remains more visible. Such vulnerability makes listing appropriate sites on the National Register of Historic Places all the more important, since listed sites are afforded the best protection under preservation laws.

Redwood National Park

About 50 prehistoric sites have been recorded within Redwood National Park. Several of these sites are along the coast. These coastal sites typically exhibit large quantities of shell middens, fire-cracked rocks, and chipped stone and bone tools, which represent either permanent or seasonal occupation by the Tolowa or Yurok. Most coastal sites are in poor condition due to previous highway construction activities, coastal erosion, and looting. Two of the coastal

prehistoric sites, the Enderts Beach and O'men Village sites, are listed on the National Register of Historic Places.

Most prehistoric sites are located inland and are primarily around Redwood Creek Basin, including five sites west of and 34 sites east of Redwood Creek. Two of the five recorded sites west of Redwood Creek probably represent major habitation sites, possibly used at different time periods by different Indian groups. Stone artifacts unearthed at the two sites suggest that the sites may have been used by both the Chilula and Yurok in late prehistory, as well as by ancestors of these or other California Indian groups.

The 34 prehistoric sites east of Redwood Creek are primarily along ridgetops which served as trail routes, and on midslope benches near springs and creeks. The sites collectively represent about 4,500 years or more of human use, variously exhibiting evidence of flaked and ground stone tools, such as projectile points, knives, scrapers, milling slabs, and handstones; chert and obsidian flakes, the refuse of stone tool making; fire-cracked rocks; and darkened soil middens stained by ashes from campfires and organic remains. Twenty-six of the sites are on the National Register of Historic Places as the Bald Hills Archeological District. Six sites in this district represent villages or seasonal camps, five of which were Chilula villages; two are short-term trail use sites; nine are concentrations of cultural remains between the villages and trails; eight are flake scatters; and one circular rock feature is a ceremonial site. The eight known sites excluded from the Bald Hills Archeological District, which represent five habitation and three trail use sites, do not possess sufficient integrity for listing on the national register.

Jedediah Smith Redwoods State Park

Seven prehistoric sites have been recorded in Jedediah Smith Redwoods State Park. Most notable is the site of Tcunsultan, a Tolowa village along the Smith River. Unusual because it is so far inland, the village may have been

established to protect and exploit fishing rights along the river. The subsurface remnants of several of the village's houses and sweathouses remain, although portions of the site have been impacted by the installation and maintenance of water and utility lines. Three of the other recorded sites are potential habitation or campsites, exhibiting scatters of flakes and soil middens. A scatter of broken projectile points near the Smith River comprises another site, and a larger rock outcrop, also near the Smith River, is reputed to be of ethnographic significance. The final site, along Mill Creek, is bedrock milling station with a possible midden component. Although none of the prehistoric sites have been evaluated for inclusion on the National Register of Historic Places, each is considered to be potentially eligible for listing until determined otherwise.

Del Norte Coast Redwoods State Park

Five prehistoric sites have been recorded in Del Norte Coast Redwoods State Park. Omenhipur, along Wilson Creek, is the site of a Yurok village that was still occupied when the first Euro-Americans arrived. Although the site has been impacted by highway construction, the subsurface remains of several village houses remain. A small rock shelter and associated midden complex comprise a second site, which is along the ocean shoreline and was probably used by the Tolowa for fishing and gathering shellfish. The park's present-day Damnation Creek Trail, which runs from U.S. Highway 101 to the ocean, follows remnants of a third archeological resource, a prehistoric and historic trail once traversed by the Indians of northwest California.

The final two sites are small shell middens. One shell midden is along Damnation Creek, and the other is along Wilson Creek. Although none of the prehistoric sites have been evaluated for inclusion on the National Register of Historic Places, each is considered to be potentially eligible for listing until determined otherwise.

Prairie Creek Redwoods State Park

Seven prehistoric sites have been recorded in Prairie Creek Redwoods State Park. Most notable are the sites of the Yurok villages of Osegen and Espa. The site of Osegen, in the vicinity of Ossagon Creek and Gold Bluffs Beach, exhibits three shallow house pit depressions and once consisted of at least four houses and two sweathouses. The site of Espa, along the Espa Lagoon, was extensively disturbed by the construction of a parking lot, but once consisted of from four seven houses and at least one sweathouse. A third prehistoric site, near Butler Creek, consists of a scatter of manos, mano fragments, and fire-cracked rocks. Among the remaining sites, two are flake scatters along the north and south perimeters of Elk Prairie, which are indicative of seasonal occupation during the spring and fall salmon runs, and one is a chert quarry near Ossagon. The final site is a trash dump with both historic and prehistoric components. The prehistoric component is probably associated with the flake scatter along the northern perimeter of Elk Prairie. Although none of the prehistoric sites have been evaluated for inclusion on the National Register of Historic Places, each is considered to be potentially eligible for listing until determined otherwise.

HISTORIC RESOURCES

The historic resources of Redwood National and State Parks range from linear features such roads and trails, to domestic refuse dumps, to buildings, structures, and cultural landscapes. The resources date from the 19th century and reflect a variety of activities, including ranching, mining, logging, overland travel, tourism, and military operations. There are no known resources within the parks associated with early sea and land exploration. Only a few of the parks' historic resources have been evaluated for eligibility for listing on the National Register of Historic Places, and none of the submerged shipwrecks along the coast have been inventoried and evaluated for inclusion on the national register.

Structures and Features — Redwood National Park

Numerous historic resources have been documented within Redwood National Park. Segments of the Old Redwood Highway, located both north and south of the Klamath River, and Radar Station B-71 are listed on the National Register of Historic Places. The Old Redwood Highway is associated with early 20th century transportation and tourism in the region, and the radar station is significant in the context of the nation's military history.

There are several historic ranch sites throughout the parks, as listed below:

- Three sites near the coast — the Joseph DeMartin Ranch Complex; the Johnston Ranch/Hamilton Hotel/Crevilli House; and the Alexander/Pozzi Ranch — are former cattle or dairy ranches dating from the late 19th century. The sites, which include few extant structural remains, consist primarily of roads, remnants of fences and corrals, scattered farm equipment, and domestic trash dumps.
- Six sites in the Bald Hills near Redwood Creek are associated with late 19th century cattle and sheep ranching. The Lyons Ranches Rural Historic District includes eight structures dating to the late 19th and early 20th centuries — two barns, three sheep sheds, two line cabins, and a bunkhouse. Each structure has been stabilized to forestall its further deterioration, and some of the structures have been determined eligible for listing on the National Register of Historic Places.
- Other late 19th century ranch sites in the vicinity of Redwood Creek basin include the Tomlinson barn ruins and a rock-lined well.
- East of Crescent City in the Little Bald Hills is Murphy's Ranch and outlying barn site, which dates circa 1884 to the 1920s. The ranch was established along the historic Kelsey Trail, a pack route linking Crescent City with the Salmon and Trinity gold mines. Archeological remains include refuse dumps,

- a water trough, a wooden springbox, fencing, and the structural remains of a burned house.
- A remnant of the Trinidad Trail was identified near Tall Trees Grove in the lower Redwood Creek basin. Initially used by mule packtrains, the Trinidad Trail connected coastal supply centers with the early gold mining sites of the interior and later served ranchers who homesteaded in the Bald Hills.

Several historic sites are associated with gold mining and logging. The site of the Union Gold Bluffs Placer Mine, which was in operation between 1872 and 1901, consists of a scatter of artifacts where structural foundations could be buried, remnants of two roads, and a refuse deposit containing earthenware, glass, water pipe fragments, and other materials. In the hills northeast of Elk Prairie is a logging camp site associated with the California Barrel Company. The site, which was established during the 1940s, includes four collapsed structures, a small refuse dump of cans and bottles, automobile frames, a water tower, and miscellaneous industrial artifacts.

Historic resources associated with the Hobbs, Wall and Company, which are scattered throughout the northern reaches of the parks, as well as on private lands, include railroad grades, trestles, buried refuse dumps, and structural foundations at former logging camps. Based in the Crescent City area, Hobbs, Wall and Company was the largest and most important lumber operation in Del Norte County, employing hundreds of workers and controlling tens of thousands of acres by 1900. Associated RNSP sites date after 1908, when the company's lumbering operations expanded into the Howland Hill/Mill Creek watershed area, to the late 1930s, when the company shut down and sold its operations. None of the resources have been recorded, researched, or evaluated for inclusion on the National Register of Historic Places.

The Prairie Creek Fish Hatchery, located off U.S. Highway 101 near Orick, was one of the first small local hatcheries developed to improve sport and commercial fishing in the area. The hatchery and associated outbuildings, which were constructed in 1936, is one of only three

remaining hatcheries that were built in California from 1871 to 1946. The National Park Service, in conjunction with the California Department of Parks and Recreation, Office of Historic Preservation (state historic preservation officer) determined that the Prairie Creek Fish Hatchery was eligible to be listed on the National Register of Historic Places.

Structures and Features — Jedediah Smith Redwoods State Park

Camp Lincoln, which is atop a grassy knoll to the east of Kings Valley Road, is designated a California state historic landmark for its significance as one of the major 19th century military outposts in the vicinity of Humboldt and Del Norte Counties. The site consists of four structures — a house, an outbuilding, a ranger's office, and a garage — but only the house and outbuilding date from the 19th-century.

Although only portions of the house may have been associated with the military post, both the house and outbuilding were later associated with 19th century dairy operations carried out on the property. The modern office and garage, which intrude upon the historic scene, are slated for removal. Remnants of fruit orchards are also on the property, to the southeast and to the north of the house.

Located within the park are the following three historic ranch sites:

- The site of the Walker Ranch, which dates from the early 20th century, is along Clarks Creek Road on the western side of the Smith River. The site consists of concrete foundations, rock and garden walls, and walkways.
- The Huffman Ranch, on Howland Hill Road near the park's western boundary, consists of a house and large garage. The wood-framed house and garage date from the 1920s, and the house is currently used as a ranger residence. Remnants of orchards are south and west of the house.
- The site of the Nickerson Ranch, along Mill Creek and established during the late 19th century, once consisted of a cabin, garden,

and orchard. Today, there are no physical remains of the cabin visible. A trash deposit is visible on the site, but it is unknown if the surface trash is associated with the original resident.

The following sites of several historic buildings and structures also dot the landscape of the park:

- The site of Lincoln School, erected in 1871 and the first school in Elk Valley, is near the park's western boundary and the intersection of Highways 101 and 199. There are no extant remains of the one-story, wood-framed schoolhouse. The site consists of a wood post fence along the property's border-line, the remains of the rope swing, and a small footbridge. It is unknown if these features are associated with the school or date from a later period.
- The Tracy property, which includes Camp Pacamo, is off of Howland Hill Road, near the park's eastern boundary. Camp Pacamo was a summer camp operated by the Tracys circa the 1920s or 1930s. The site consists of a house, an open sleeping shelter, and a storage shed, all of which are associated with the summer camp, and a modern house dating from the 1950s or 1960s. The modern house, which has no historical significance, is currently used as a ranger residence.
- The site of the Hickock House is along Mill Creek. No physical remains of either the house or farm, which were established during the 1870s, remain.
A water flume is along Rock Creek near the park's boundary. The extant portion of the flume runs for less than 0.25 mile along the creek. The flume's dates of construction and its original use are unknown.

Several historic resources within the park are associated with early modes of transportation. Old Howland Hill Road, which runs east-northeast from the western entrance of the park to Stout Grove, and Little Bald Hills Road, which opens south off of Howland Hill Road near the eastern boundary of the park, followed old Indian trails and were later adapted to accommodate mule packtrains, wagon trains, and eventually automobiles. Historically, the Old

Howland Hill Road was a major 19th century transportation corridor between Crescent City and Illinois Valley of Oregon, and Little Bald Hills Road connected the Kelsey Trail with the Catchings Ferry crossing of the Smith River.

The site of Peacock's Ferry is at the end of the Walker Road on the banks of the Smith River, and is significant as one of only two 19th century ferry operations across the river. Today, no artifacts associated with the 19th century ferry exist. One terminus of the ferry was on the northeast bank of the river, which is not within the park boundary and now consists of a sandy cut between two rock outcrops. All evidence of the ferry terminus on the southeast bank of the river, which lies within the park, was obliterated by the shifting course of the river and flooding.

Structures and Features — Del Norte Coast Redwoods State Park

The Old Redwood Highway, a narrow, two-lane, hard-surfaced road originally constructed in 1923, traverses the western section of the park. In 1932–33 the road was realigned between Last Chance and Damnation Creek. The road's realignment was designed by Frederick Law Olmsted Jr., to both rectify problems caused by sliding and preserve scenic values in the park. Today, the road is used as a segment of the Coastal Trail.

Also within the park are the remains of the Del Norte Southern Railroad. The railroad was a subsidiary of the Hobbs, Wall and Company, which controlled large land and timber holdings throughout the region during the late 19th and early 20th centuries. The railroad was constructed into the Mill Creek drainage to transport lumber over Howland Hill to the Hobbs, Wall Company mill in Crescent City. Two of the former railroad's large redwood trestles are along the Trestle Loop Trail, near the Red Alder Campground. A portion of a skid road is also in the campground, with wooden puncheons visible for about three feet. Debris associated with railroading and logging operations is also along

the Trestle Loop Trail, including metal wheel cogs, steel cable, and wooden puncheons.

Structures, and Features — Prairie Creek Redwoods State Park

The Prairie Creek Redwoods State Park visitor center and associated structures, which are at the northwest end of Elk Prairie, are all historically significant as examples of Civil Conservation Corps (CCC) construction carried on in state parks during the 1930s. The site consists of the headquarters building, a comfort station at the rear of the headquarters building, a footbridge to the northeast, and a concrete picnic stove along the south side of Prairie Creek. The headquarters building, which retains its architectural integrity and its original appearance (with the exception of the handicap access), is also significant as an example of the rustic, nonintrusive architectural style pioneered by the National Park Service between 1916 and 1942.

The Boyes House and associated structures are in the northeastern section of Elk Prairie. The site consists of an early 20th century Bungalow Style residence, a detached garage built circa the same period as the house, four modern park maintenance buildings, three one-story cottages (erected ca. 1947–48), and a small orchard that surrounds the south and western sides of the Boyes House. The residence and garage are historically significant for their association with the Boyes family, who operated a dairy and resided there continuously until the mid-1930s. The three cottages exemplify the California Bungalow as it was adapted and mass produced just after World War II.

Several other sites of historic buildings and structures are also in the park, as follows:

- The Huggins Homesite, which is near the beach on the north side of Ossagon Creek, was homestead in 1914 by Frederick Huggins, who remained in continuous occupancy until 1967. The three structures that once occupied the site — a three-room residence, a barn shed, and a large coop — burned to

the ground during the mid-1970s. The site now consists of the partially burned foundation, joists of the three structures, and scattered charred wood debris.

- The site of the Caruther's Cove Cabin, which is on a bluff overlooking the ocean at the mouth of Johnson Creek, consists of the cement foundations of a house. The date of the house's construction is unknown. Above the same creek are remnants of a ditch excavated for the Amony Placer Mine.
- The Indian Tree House, 50-feet northeast of the park headquarters building, is a very large redwood with a burned-out hollow in its trunk. The interior is about 175 square feet in size and contains an earthen floor. The entrance consists of a door frame built of hand-hewn lumber. Although locally reputed to have been used by American Indians, the structure was probably constructed circa the 1920s as a tourist hoax or curiosity.
- The Old Cabin and Store Site is at the south end of Boyes Prairie. The construction dates of the several small frame tourist cabins and store that occupied the site are unknown, and they were razed ca. 1967. The site now consists of earthen depressions and debris scatter.
- The site of the Civil Conservation Corps camp that housed CCC Company 1903 is in the northwest section of Elk Prairie. The original camp consisted of 14 temporary buildings, but the buildings were removed from the site during the late 1930s after the corps was disbanded. The site currently consists of a few roadbed and building depressions in the prairie.

The site of the Gold Bluffs Mining Camp is in Alexander Lincoln Prairie, near Fern Canyon. The site was first used as a mining camp in the 1850s. A second period of occupation and use occurred between 1870 and the early 20th century. With the exception of sawn cabin planks, buried beams, and sawn nails, the site contains no extant remains of buildings and structures, but wagon remains, stove parts, and green glass are scattered about. No privy or trash pits have yet been located.

A segment of the roadbed of the Old Redwood Highway, which predates the present highway alignment, runs from the southern end of Elk Prairie north to the Big Trees area. This segment of the old highway is currently known as the Foothill Trail.

Submerged Resources

To the west, Redwood National and State Parks extend seaward 0.25 mile beyond the mean high tide line of the Pacific Ocean. In addition, the state of California has title to all submerged land and the land below the mean high tide line. A number of known shipwrecks have occurred within these boundaries; however, no inventory of underwater resources has been conducted.

Cultural Landscapes

According to the National Park Service's *Cultural Resource Management Guideline* (NPS-28), a cultural landscape is

a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

Shaped through time by historical land use and management practices, as well as politics and property laws, levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past, a visual chronicle of its history. The dynamic nature of modern human life, however, contributes to the continual reshaping of cultural landscapes; making them a good source of information about specific times and places, but at the same time rendering their long-term preservation a challenge.

A draft "Cultural Landscape Inventory (level 0)," which identifies potential cultural landscapes, was completed for Redwood National and State Parks in 1997. A cultural landscape inventory documents up to three scales of information — landscapes, component landscapes, and features. A cultural landscape encompasses the largest contiguous area that is potentially eligible for the National Register of Historic Places. Some areas within a landscape may be further documented in more detail as component landscapes, which are definable physical components of a landscape that either contribute to the overall landscape's significance or are significant in their own right. Features include individual elements that comprise a cultural or component landscape, such as fences, paths, agricultural fields, irrigation systems, or vistas.

According to the inventory, Redwood National and State Parks contain at least seven cultural landscapes that are potentially eligible for listing on the National Register. Currently, there are no identified component landscapes. Four of the potential cultural landscapes are in Redwood National Park, two are in Jedediah Smith Redwoods State Park, and one is in Prairie Creek Redwoods State Park, as shown below:

Redwood National Park

- The landscape associated with the Lyons ranches is significant as an example of a natural landscape that was manipulated by both American Indians and Euro-Americans, with evidence of both still remaining. The Bald Hills Archeological District (see below), which is listed on the National Register of Historic Places underlies the boundaries of the property.
- The Bald Hills Archeological District, which is listed on the national register and collectively exhibits about 4,500 years or more of human use, encompasses 26 sites (see description in the discussion of prehistoric resources in Redwood National Park earlier in this chapter).

AFFECTED ENVIRONMENT

- Radar Station B-71, which sits atop an ocean bluff south of Klamath, is a rare example of a World War II early warning radar station. The site consists of two structures and other military features, including radar antennas and two machine gun emplacements.
- The Prairie Creek Fish Hatchery, off U.S. Highway 101 near Orick (see earlier description in the "Historic Resources" section of this chapter under the discussion of structures and features in Redwood National Park). The hatchery is also associated with the development of U.S. Highway 101 and the town of Orick.

Jedediah Smith Redwoods State Park

- Camp Lincoln, which is east of Kings Valley Road, is a California state historic landmark (see earlier description in the "Historic Resources" section of this chapter under the discussion of structures and features in Jedediah Smith Redwoods State Park).
- The Kelsey Trail, a 19th-century pack route that linked Crescent City with the Salmon and Trinity gold mines.

Prairie Creek Redwoods State Park

- The Prairie Creek Redwoods State Park visitor center and associated structures (see earlier description in the "Historic Resources" section of this chapter under the discussion of structures and features in Prairie Creek Redwoods State Park).

In addition, some prairies may be eligible for listing on the national register as ethnographic landscapes that were maintained through traditional practices such as burning and thinning.

ETHNOGRAPHY

Ethnographic resources are defined by the National Park Service as any

site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. (*Cultural Resource Management Guidelines*, 1996:191).

The lands comprising Redwood National and State Parks are part of the ancestral territories of the Tolowa, Yurok, and Chilula:

- Tolowa — Before 1850 the Tolowa controlled an approximately 640-square-mile area, extending southward along the coast from the mouth of the Winchuck River in extreme southern Oregon to the ridge between Wilson Creek and those creeks that flow into the Smith River. The Tolowa's lands encompassed most of the Smith River watershed. The Tolowa spoke an Athabaskan-affiliated language that is akin to dialects spoken both to the north and south. Before historic contact, the Tolowa numbered an estimated 2,400 individuals.
- Yurok — Bordering the Tolowa on the south, Yurok territory extended along the coast from the ridge line along Wilson Creek southward to Little River below Trinidad and along the lower 45 miles of the Klamath River drainage. The Yurok spoke an Algonkian-affiliated language that may be related to the language of their southern neighbors, the Wiyot. The estimated population of the Yurok in 1848 was 2,500.
- Chilula — Flanking the Yurok on the east, the Chilula inhabited most of the lower Redwood Creek drainage plus the Bald Hills district. They spoke an Athabaskan-affiliated language that is almost indistinguishable from that spoken by their eastern neighbors, the Hupa, who controlled the lower Trinity River area. The Chilula numbered an estimated 600 individuals in 1848.

The Chilula no longer exist as a group. Those who survived Euro-American contact became a part of the Hupa, who live immediately east of the parks.

In 1988 the Hoopa-Yurok Settlement Act was passed. This divided the Hoopa Valley Indian Reservation into the Hoopa Valley Reservation and the Yurok Reservation. Since that time, the Yurok Tribe has established a government. Within the reservation, about 1,100 to 1,200 acres of land and waters are federal lands within the parks that are administered by the National Park Service.

In spite of difficulties, the American Indian community of northwestern California has persisted and, in fact, exhibits great variety and vigor. The Indian culture has grown, changed, and adapted, just as European culture has. While some Indian people live on reservations, near or on the land of their ancestors, others live in local towns and cities. There is currently no one in the vicinity of Redwood National and State Parks who is living the way Indian people lived in the years before 1850, any more than there is a member of the dominant culture who is living the life of a mid-19th-century miner, farmer, or merchant. Although no one is living a strictly traditional Indian life, few have wholeheartedly opted for an entirely modern lifestyle. Most people straddle an area between the mainstream culture and their evolving Indian culture.

Ethnographic Resources

An initial inventory of ethnographic resources in Redwood National and State Parks exists, but none are currently listed on the National Register of Historic Places as ethnographic resources. Local Indians have ties to many of the prehistoric sites throughout the parks, and numerous sacred and ceremonial sites continue in use today. One prominent ceremonial site is the Brush Dance Site, which is on the south bank at the mouth of the Klamath River. The Yurok Tribe is currently evaluating the eligibility of the Brush Dance Site for inclusion on the National Register. Other sites within the parks are the locations of traditional uses, particularly the gathering of plant materials for basketmaking. In addition, some prairies may be eligible for listing on the national register as ethnographic land-

scapes that were maintained through traditional practices such as burning and thinning.

Relationships with the American Indian Tribes

RNSP staff has held regular consultations with the American Indian community since 1978. In 1978, in conjunction with the 1980 *General Management Plan* and the beginning of an inventory of traditional places important to the Indian community, park staff held a meeting of elders and others who had traditional ties to national park lands. One of the results of this meeting was the establishment of five American Indian heritage advisory committees, representing both different geographic areas of the national park and different Indian groups. Until the 1990s, the park staff worked with these committees on a variety of issues, including the review of draft planning and environmental documents, the review of proposed park projects and policies, participation in cultural resources projects (e.g., archeological surveys and excavations), access to and use of traditional lands and resources, interpretation of American Indian culture and lifeways, and the employment of American Indians.

In the 1990s consultations shifted from the heritage advisory committees to tribal governments. There are five tribal governments whose members have traditional ties to lands now within the parks. The five tribal governments include three Tolowa governments (Smith River Rancheria of California, Elk Valley Rancheria of California, and the Tolowa Nation); the Yurok government (Yurok Tribe of the Yurok Reservation, California; Coast Indian Community of Yurok Indians of the Resighini Rancheria, California; Big Lagoon Rancheria of California; and Cher-Ae Heights Indian Community of the Trinidad Rancheria, California); and the Hoopa Valley Tribe of the Hoopa Valley Reservation, California. Only the Tolowa Nation is not federally recognized. Most NPS consultations are with the Yurok Tribe, whose ancestral territory includes much of the national park. However, the park staff also works with the

Hoopa Valley Tribe, the Smith River Rancheria, and the Tolowa Nation. The Yurok and the Hoopa Valley Tribes are self-governing tribes, and the Yurok have assumed state historic preservation office functions for all lands within the reservation boundaries.

Redwood National Park has had a designated American Indian liaison position since 1980, and the same person has served in that position since then, ensuring a certain amount of trust in the Indian community. Other RNSP staff members are also committed to spending the time necessary for developing working relationships. In addition, there is an active interest throughout the parks in developing an RNSP interpretive program with a strong ethnographic emphasis, and RNSP staff provides assistance with tribal events, materials for traditional projects, and supports the continuation of traditional ceremonies.

In 1996 a memorandum of understanding (see appendix D) was signed by the National Park Service, the California Department of Parks and Recreation, and the Yurok Tribe, establishing and formalizing a government-to-government relationship. The memorandum provides for

- holding regular meetings for updating and reviewing projects
- consulting with the tribe on actions that affect tribal governments and trust resources
- working toward implementing the Tribal Self-Governance Act of 1994
- pursuing opportunities to work cooperatively on economic development projects that will be to the benefit of both the Redwood National and State Parks and the tribe
- collecting natural resources for traditional activities
- sharing information for inventory and management of RNSP lands
- working toward the parks' recruitment and employment of tribal members

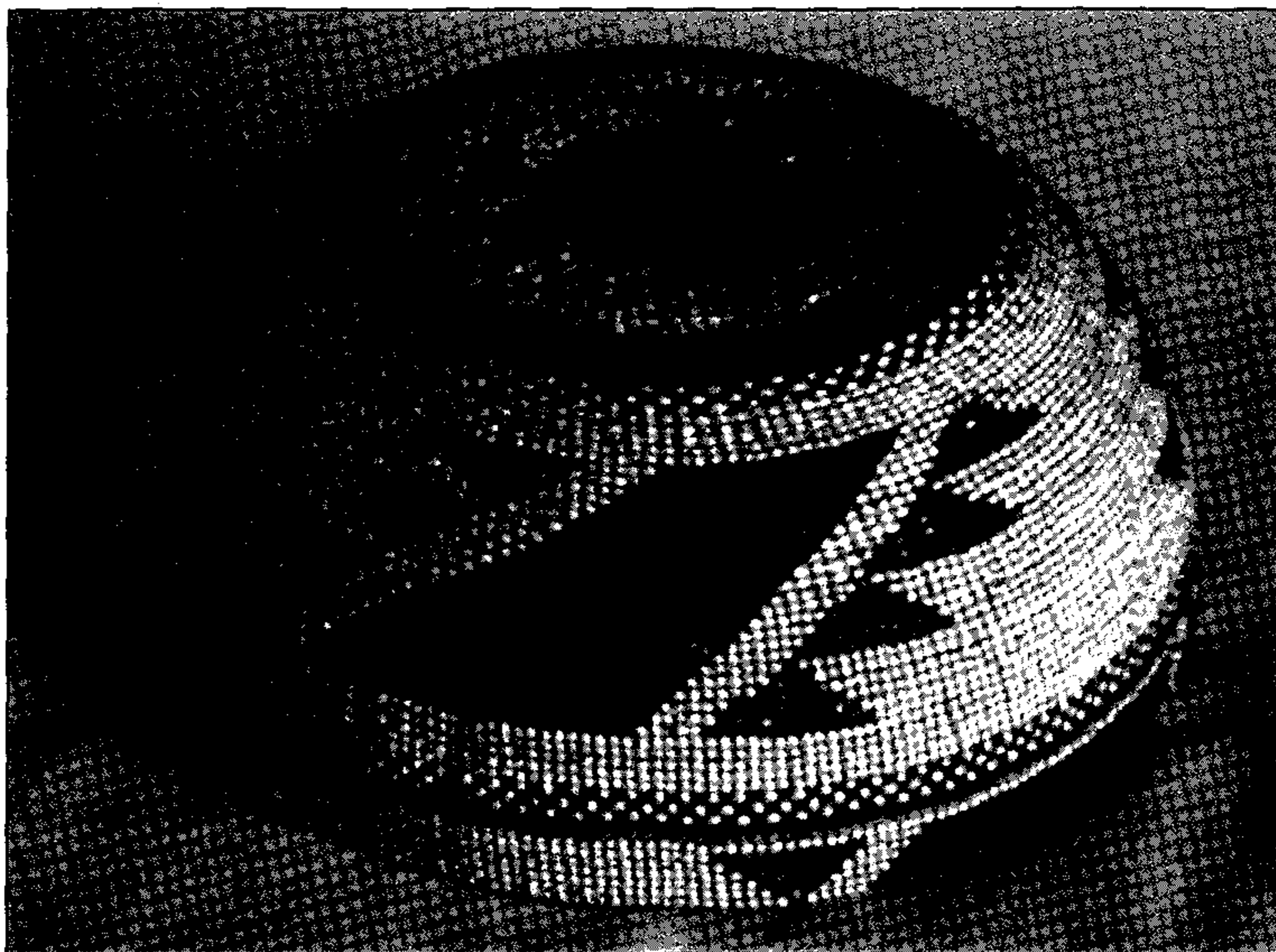
The Yurok Tribe is participating directly in this joint plan process, with a representative serving as an active consultant.

COLLECTIONS

The RNSP collections contain more than 50 American Indian baskets, about 25,000 archeological objects, nearly 5,000 herbarium specimens, and 85 historical objects. Also, Redwood National Park is unique in the national park system for its extensive watershed rehabilitation program, and the records and items associated with this program, as well as other administrative history documents, are also kept in the collections. A substantial number of accessioned objects have never been cataloged, including a photographic collection of about 4,000 objects and an estimated backlog of 400,000 natural resource management materials, consisting primarily of photographs and documents.

Curatorial responsibilities were a collateral task until 1996, when Redwood National Park hired a full-time curator to manage the parks' collections and provide curatorial assistance to three other national park system units in the region. A museum management plan has been drafted that addresses four separate issues for the parks: establishing collection accessioning protocols and updating the "Scope of Collection Statement"; developing adequate museum collection storage facilities; providing access to the collections and their contents for RNSP staff and the public; and determining programming costs and procedures for archival processing of archives and resource management materials, including documents, photos, and specimens.

Appropriate museum collection storage facilities do not yet exist in the parks, although an interim facility was established at the Arcata Office building. Collections can be found throughout the parks at Requa, Wolf Creek, the South Operations Center, and the Crescent City headquarters.



Demonstration of basket weaving using traditional materials. NPS photo.

VISUAL AND SCENIC RESOURCES

INTRODUCTION

Redwood National and State Parks include many of California's most significant and irreplaceable natural and cultural visual resources, including the largest remaining stands of old-growth coast redwoods, prairie vistas, historic ranchlands, wild rivers and unspoiled coastlines. Effective management and protection of these and other visual resources require a method to identify areas of visual sensitivity and provide a basis for further project-specific visual analysis.

A method for understanding the visual resources within this region follows, including definitions of terms, a description of regional landscape character and units, and a description of landscape types.

VISUAL RESOURCE TERMS

Landscape Character

Landscape character refers to the overall impression created by the unique combination of all visual landscape features. Landscape character is commonly described in terms of scale, line, form, color, texture and density. How these variables come together, and the degree to which they are visible to an observer, largely determines scenic quality.

Landscape Unit

Landscape units describe areas of similar character within a region. The edges dividing one unit from another are often defined by changes in geologic features, vegetation communities, cultural elements, and other visual boundaries. Each landscape unit is given a name based on its dominant geographic features. For example, the visual landscape character of a prairie and ranchland unit is distinctly different from that of an old-growth redwood unit.

Macro and Micro Landscapes

Macro landscapes appear relatively unified, with similar or complementary features extending far into the distance. Most features can be seen at a glance from any one of a number of vantage points. A view from an open hillside, prairie, or coastline are examples of a macro landscape.

A micro landscape also has similar or complementary features. However, from within a micro landscape, views are screened to a short distance from any given vantage point. For example, visual experiences from deep within an old-growth redwood forest are typical of micro landscapes.

Landscape Types

Landscape types are used to classify levels of visual sensitivity. A landscape type is an area of similar landform and land cover. Landform generally refers to topography or slope, and land cover usually refers to the predominant vegetation. Landscapes having similar landform and cover will have similar sensitivity to comparable degrees of development. One or more landscape types may occur repetitively within a single landscape unit.

Observer Response (Viewpoints)

Highways, roads, trails, and beaches, in combination with specific observation points, provide a changing series of views for RNSP visitors. The view changes depend on the visitor's location, direction of and obstructions to views, recreational activity, seasonal changes (leaves on or off trees), and weather phenomena such as fog, rain, and clouds. The visitor experience is influenced by these changes.

Dynamic Landscapes

Landscapes, whether macro or micro, are constantly changing. Landscape change over time is an outcome of both natural and cultural processes. For example, the short-term visual impact of a reclamation project may eventually result in long-term visual benefits.

LANDSCAPE CHARACTER AND UNITS

Redwood National and State Parks share a regional setting that includes some of the most unique and spectacular visual character of any place on earth. Most of the visual resources within this region remain a tremendous source of wonder and inspiration for millions of visitors.

For purposes of this planning effort, the regional landscape has been characterized into five distinct landscape units. The visual effect on an observer varies considerably depending on such things as location of the observer, topography; specific kinds of density and configuration of vegetation; season; time of day; and weather. The role and importance of each of these needs to be factored into the visual analysis and treatment recommendations for a development project.

Old-Growth Redwood Groves

Old-growth redwood groves are a prime visual resource and are a distinct landscape unit. Old-growth redwood groves become visually distinct in macro landscapes when they form an edge along open landscapes such as prairies, coastlines, and large rivers. Typically, old-growth redwood groves provide observers with an awe-inspiring micro landscape experience.

Generally, views within old-growth redwood groves are restricted to an immediate area. The dominant visual orientation is vertical. The edges of groves are visually sensitive to change. Screening development within groves is possible with adequate visual buffering.

Previously Harvested Redwood and Mixed Forests

Second- and third-growth redwood forests and mixed forests are obvious in the regional landscape. From a macro landscape perspective, these forests typically have varying visual signatures resulting from variations in line, form, color, texture and vegetation density. These variations are an outcome of forest age, original method of harvest, location of the forest, and vegetation species.

Typically, previously harvested and mixed forests are densely vegetated and views can be greatly restricted. Screening development is possible if an adequate buffer is maintained. New clearings are generally very apparent. The micro landscape in previously harvested areas has changed considerably since park expansion in 1978. Trees are now 20–50 years old, and in many areas the lower limbs of these young trees have dropped off, which has and will continue to improve visibility under the second growth.

Coastline and Coastal Environments

In addition to the world-renowned redwood forests and groves, the region's picturesque coastline and associated coastal environments are prime visual resources. Impressive, jagged rock outcrops and cliffs enclose or alternate with beaches of varying extent. Coastal bays, coves, tidepools, marshes, and river mouths add tremendous visual contrasts and variety.

Coastline and coastal environments are visually dynamic landscapes, having dramatic contrasts and expansive views. Coastline and coastal environments provide an endless variety of micro and macro visual experiences.

Coastline and coastal environments commonly have unobstructed surrounding views. Development is not easily concealed. The scale, line, form, color, and texture of structures can easily intrude on coastal landscape character. Clearings and other coastal development activities can be

very apparent from higher vantage points such as hillsides and bluffs.

Rivers and Streams

Drainages from the rivers and streams that cut through the coastal ridges on their way to the ocean provide additional visual variety and seasonal variation to the landscape. The finest redwood groves are usually found bordering these drainages on associated flat alluvial benches.

Visually, rivers and streams are especially significant if they are adjacent to heavily forested landscapes or dramatic geologic features. Depending on adjacent landforms and land cover, large rivers and streams provide spectacular macro viewing opportunities while smaller streams tend to provide more inwardly focused micro experiences.

In general, rivers and streams are visually exposed landscapes that provide partial views to surrounding areas. Development is not easily concealed because of the visual contrasts that naturally exist near the stream or river channel. Clearings and other development activities along rivers and streams are typically very visible from the channel and higher vantages such as hillsides or bluffs.

Prairies and Ranchlands

Open meadows, prairies, and ranchlands provide strong contrasts and visual variety to the predominantly forested landscape of this region. These units may contain numerous highly visible cultural elements that become significant landscape features. Some of these features dominate the landscape and strongly influence overall visual quality.

Prairies and ranchlands frequently provide a pastoral visual experience, especially when associated with cultural features such as ranch structures. Prairies and ranchlands are especially significant if located near shorelines, adjacent to

rivers, or on ridges. Prairies and ranchlands often provide strong macro visual experiences.

Typically, open prairies and ranchlands provide exceptional views to surrounding areas. Development is not easily concealed and can intrude on landscape character. Changes in prairie edges, typically defined by treelines and ridges, are very noticeable. Within prairies and ranchlands, the effects of prescribed fire or agricultural activities can visually impact the landscape. Depending on land forms, land cover, and viewshed, these impacts can visually dominate the landscape.

LANDSCAPE TYPES AND SENSITIVITY

Twelve landscape types have been identified for Redwood National and State Parks. The landform (slope) and land cover category together are the basic tools for determining the sensitivity of any specific area or site to development, or how capable it is of visually absorbing change without detrimental impacts on scenic quality. Different landscape types may appear more than once within any given landscape unit.

Landscape types are based on the following land form and land cover characteristics:

Landform:	Land Cover:
Flat (0-4%)	Open (minimum cover)
Rolling (5-19%)	Semi-open
Steep (20-39%)	Moderately forested
	Heavily forested
	(maximum cover)

Landscape types with **high** sensitivity lack potential intervening elements, and the addition of structures and other developments will be apparent and contrast with existing conditions.

Landscape types with **moderate** sensitivity have the opportunity for intervening elements and have a more complex topography that could potentially conceal structures and other developments and reduce the visual impact.

Landscape types with low sensitivity offer the most opportunities, in terms of macro landscapes, for concealing structures and other

developments by a combination of landforms and vegetation.

TABLE 13: LANDSCAPE TYPE VISUAL SENSITIVITY MATRIX

Landform	Land Cover			
	Open	Semiopen	Moderately Forested	Heavily Forested
Flat	Highly sensitive	Moderately sensitive	Low sensitivity	Low sensitivity
Rolling	Highly sensitive	Moderately sensitive	Moderately sensitive	Low sensitivity
Steep	Highly sensitive	Highly sensitive	Moderately sensitive	Moderately sensitive



VISITOR ACCESS AND CIRCULATION

ACCESS

Redwood National and State Parks are linear in configuration, extending nearly 50 miles in northwestern California, 35 miles of which is along the coast. U.S. Highway 101 is the major north-south route through the parks and provides easy access from the south and from the coastal region of Oregon. U.S. Highway 199 provides access to the parks from the interior area of Oregon. A short section of State Highway 197 bisects the northernmost section of the parks.

The only direct access from the east is a county road that originates at State Highway 169 at Weitchpec and extends into the parks. This road eventually becomes the Bald Hills Road and connects to Highway 101 just north of Orick. Major sections of the county road and state highway are unpaved.

The total maintained road system within the parks consists of about 28 miles of major paved roads, 25 miles of minor paved roads, and 25 miles of gravel roads. The California Department of Transportation (Caltrans) is responsible for the operation and maintenance of all state and federal highways that pass through the parks.

The parks are also accessible by air from airports at Crescent City, just west of the northern section of the parks, and the Eureka-Arcata airport 28 miles south of the parks in McKinleyville. These airports have regularly scheduled commercial flights, which are often hampered by fog and bad weather.

The parks are also accessible by bus. Del Norte County has bus routes with destinations to specific attractions within the parks.

CIRCULATION

In addition to the highways, circulation in the parks is accomplished by several small, internally used and maintained roads (both paved and unpaved). These roads are expected to handle the moderate increases in traffic expected

in the future. Some of these roads dead-end. Several roads are attractions unto themselves. Some of these roads are important to local traffic. Below are the more significant roads, from north to south.

Howland Hill Road

Howland Hill Road is a narrow, two-way, 8-mile, unpaved road primarily through the old-growth redwood forest in Jedediah Smith Redwoods State Park. Howland Hill Road serves as an alternate route for State Highway 199 traffic should that road be closed east of Hiouchi. The road climbs into a tributary of Mill Creek near Howland Hill Outdoor School and follows the creek as it flows toward its junction with the Smith River at Stout Grove. The road connects with U.S. Highway 199 on the east side of the state park. The road also provides automobile access to the parking area at Stout Grove and is used by local traffic. Trailers and motor homes are discouraged on this road. The road was originally constructed as a toll stage road in the late 1880s.

Enderts Beach Road

Enderts Beach Road is a 1.5-mile, two-way paved road that begins at Highway 101 about 3 miles south of Crescent City. The first 0.5 mile is not within RNSP boundaries and is owned by Del Norte County. Enderts Beach Road was formerly part of the Old Redwood Highway (Highway 101). The road now ends at the Crescent Beach overlook, where the original road has been converted to a foot trail that is part of the Coastal Trail and provides access to the Nickel Creek primitive campground

Del Norte Coast Redwoods State Park Entrance Road

The road into Del Norte Coast Redwoods State Park is a 2.5 mile, two-way paved road

providing access from Highway 101 to the Mill Creek campground. The road is on unstable materials and is subject to slumping and failure causing occasional closures. It is steeper than desirable for public access. The road was originally designed for access during campground construction rather than public access.

The Coastal Drive

The Coastal Drive is a remnant of the Old Redwood Highway. A 5.5-mile, two-way, unpaved section of the old highway, between Prairie Creek Redwoods State Park and the mouth of the Klamath River, is open to vehicles. The segment of Coastal Drive from High Bluff south was originally constructed as part of the Redwood Highway (Highway 101) during the early 1920s. The road is on unstable materials and is subject to slumping and failure causing occasional closures. The road was paved when it served as the main highway, but as sections fail, they are replaced with a graveled surface. There were major failures on this road following a severe storm on January 1, 1997. Most of this road within the parks crosses the headwaters of small unnamed coastal streams that drain directly into the Pacific Ocean. The southern portion in Prairie Creek Redwoods State Park crosses the headwaters of Johnson and Ossagon Creeks, which drain into the ocean. The southern terminus of the road is in the headwaters of McGarvey Creek, a tributary of the Klamath.

Newton B. Drury Scenic Parkway

Newton B. Drury Scenic Parkway runs about 11 miles through Prairie Creek Redwoods State Park. The road is a two-lane paved road. The parkway serves as an alternate route for Highway 101 if the bypass is closed in an emergency. The California Department of Parks and Recreation operates the road, with special operational/maintenance requirements defined by Caltrans. The road was constructed in 1928 and served as the main route of Highway 101 (the Redwood Highway) before the 101 bypass was completed in 1992.

Cal-Barrel Road

Cal-Barrel Road is a 3-mile-long scenic park drive that branches from the Newton P. Drury Scenic Parkway. It is an unpaved, narrow, winding road that ascends from Boyes Creek into the upland and headwaters reaches of associated small streams and drainages, including Browns Creek near the terminus of the road. The public portion of the road runs for 3 miles in the state park, ending at a small vehicle turn-around near the 101 bypass. No trailers are allowed on this road. The road was originally constructed for access to private timber lands in the late 1800s.

Davison Road— Gold Bluffs Beach Road

Davison Road is a county road that extends 5 miles westward from Highway 101 to Gold Bluffs Beach. Davison Road becomes Gold Bluffs Beach Road, which parallels the beach for 4 miles and ends at a parking area at the base of Fern Canyon. The two-way road is mostly unpaved and trailers are not allowed on this road. The road was an old timber harvest or mining road.

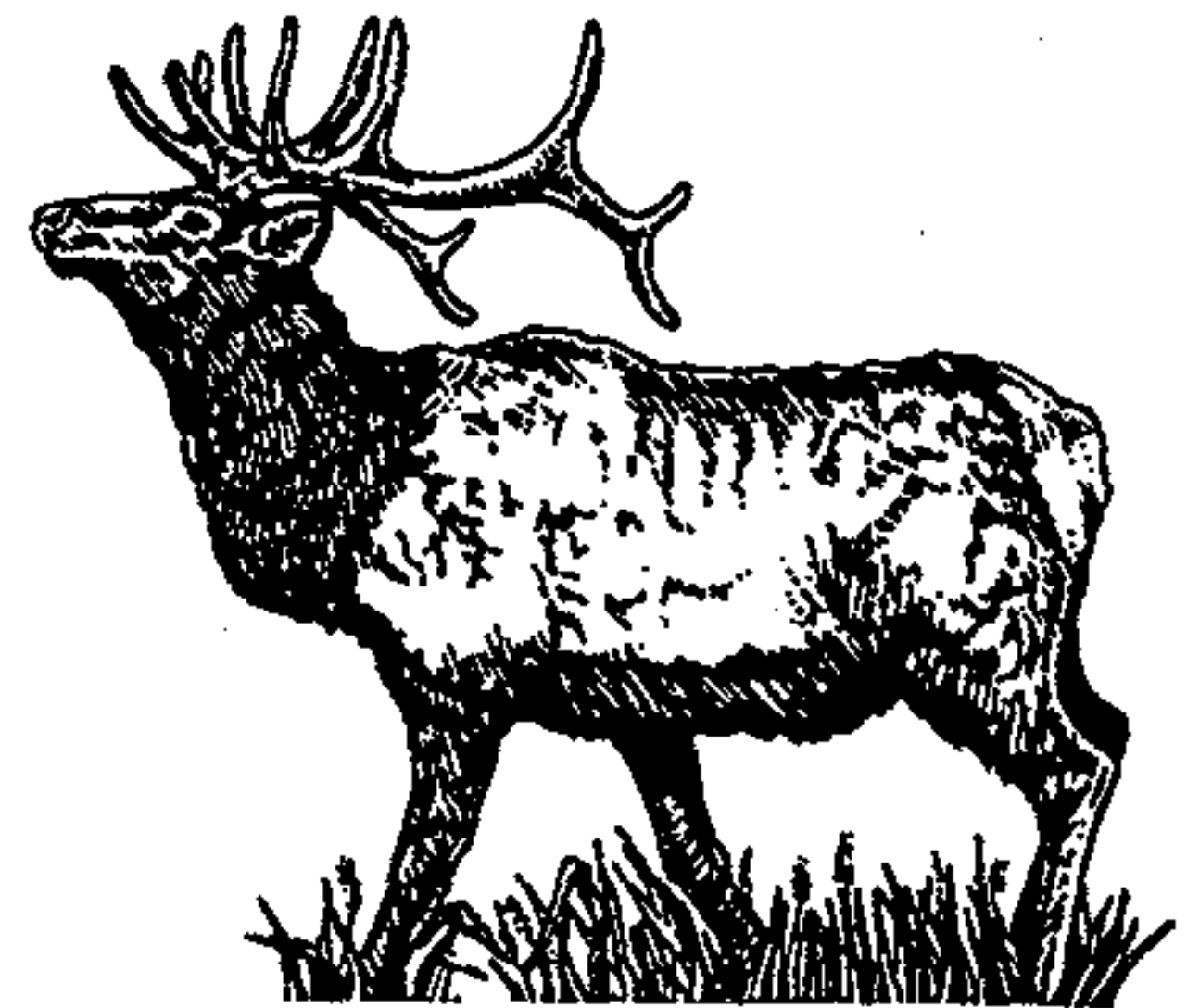
Bald Hills Road

Bald Hills Road is a two-way county road extending for 18 miles through the national park from Highway 101 in a southeast direction to the Klamath River at Weitchpec. The northwestern part of the road is paved. As it leaves Highway 101, the road winds steeply to Lady Bird Johnson Grove and continues to the Tall Trees access road and to many waysides, pullouts and trailheads in the Bald Hills and the Redwood Creek basin. Bald Hills Road is the primary access road into this area of the parks. This road also provides access to private property, including timber lands.

Tall Trees Access Road

Tall Trees access road is a 6-mile-long unpaved road extending from Bald Hills Road to the Tall Tree Grove trailhead area. This road provides the closest access for automobiles to the Tall Trees Grove. Vehicle access is managed, and the road

is open to private automobiles by permit only. The road crosses the headwaters of several small tributaries of Redwood Creek including Cloquet, Miller, Cole, and Emerald Creeks. The Tall Trees access road is the former Simpson Timber Company C-Line road built in the 1940s or early 1950s.



VISITOR USE AND EXPERIENCE

OVERVIEW

Visitors initially come to Redwood National and State Parks to see the ancient redwood forest and some of the world's tallest trees. The parks provide a whole spectrum of opportunities for visitors to see, experience, and enjoy redwood trees. The experience can be as fleeting as images of redwood trees flickering past the windshield as a visitor drives through the parks or as magical as sitting alone in an ancient redwood grove while fog from the Pacific Ocean filters into the forest canopy. There are many other natural and cultural resources, and opportunities to enjoy those resources, that may not have been apparent to visitors when they first decided to "see the redwoods." Other significant resources within the parks include: 35 miles of Pacific Ocean coastline, portions of the Redwood Creek, Klamath River, and Smith River watersheds, resources related to the four American Indian cultures that have traditional ties to RNSP lands, prairies and oak woodlands of the Bald Hills, more than 850 species of plants (in addition to redwoods), more than 350 species of birds, and more than 200 species of other wildlife, including the very visible Roosevelt elk.

The infrastructure to support and facilitate visitor opportunities to enjoy the parks' resources have been developed primarily in the state parks, and along the major roads in the national park.

Within the parks there are four drive-in campgrounds, four primitive walk-in campgrounds, two primitive equestrian camps, 164 miles of hiking trails, 41 miles of trails for horseback riding, and 56 miles of bicycle trails. In addition to the parks' two main access highways, U.S. Highways 101 and 199, there are numerous lower speed scenic roads with pulloffs and overlooks — Howland Hill Road, Enderts Beach Road, Coastal Drive, Newton B. Drury Scenic Parkway, Cal-Barrel Road, Davison Road, and Bald Hills Road, as described in the previous "Visitor Access and Circulation" chapter.

To orient visitors and increase their understanding and appreciation of the parks' signifi-

cant resources, there are three information centers (one near each of the parks' three main entry points) and two visitor centers (one in Prairie Creek Redwoods State Park and one in Jedediah Smith Redwoods State Park). None of these facilities is large, and visitors depend mainly on interaction with RNSP personnel at the information desks to obtain adequate way finding orientation and activity planning information. The parks do not have a facility with interpretive media designed to provide visitors with in-depth interpretation of the parks' primary interpretive themes, although all five centers have exhibits that provide introductory information. In-depth interpretation of the parks' resources is provided primarily through formal interpretive programs given in the outdoor amphitheaters in each of the state park campgrounds, and through the publications sold in each of the information centers and visitor centers. RNSP staff operate the Wolf Creek Education Center and the Howland Hill Outdoor School to provide resource-based environmental education opportunities to school groups within the northern California region.

The previous "Visitor Access and Circulation" chapter describes how to get to the parks.

WHO VISITS REDWOOD NATIONAL AND STATE PARKS?

The combined visitation of Redwood National and State Parks was more than a million visitors in 1994. (See the discussion under the "RNSP Visitor Use" heading in the "Socioeconomic Profile" section for the possibility of duplication of visitor counts.) Two visitor surveys completed in the 1990s provide demographic information about visitors to Redwood National and State Parks. Both surveys were conducted in the middle of the busy summer season. The first was completed the week of July 25–31, 1993, by the Cooperative Park Studies Unit, University of Idaho. Visitors were surveyed at six national park sites — Crescent City Information Center, Crescent Beach overlook and picnic area, Hiouchi information center, Lady Bird Johnson

Grove, Lagoon Creek, and Redwood Information Center and 632 visitor groups responded (out of 798 questionnaires distributed).

The second survey was conducted by the Natural Resource Planning and Interpretation Department, Humboldt State University, during the week of July 9–15, 1995. Visitors at seven state park areas — Mill Creek campground, Stout Grove, Jedediah Smith Redwoods State Park campground, Big Tree, Elk Prairie Parkway, Fern Canyon, and Gold Bluffs Beach — were surveyed, and 644 visitor groups (out of 805 distributed) returned their survey forms. Both surveys requested the same information from visitors, distributed similar numbers of questionnaires, and had a nearly identical response rate.

Although both surveys found that more than 50% of visitors were from the states of California, Oregon, and Washington, the survey of state park sites recorded a significantly higher proportion of visitors from California. Almost half of all foreign visitors to both national and state park sites were from either Germany or Canada. The majority of all visitors surveyed were first-time visitors to the parks. Fifty-two percent of visitors surveyed at state park sites identified the parks as their primary destination, but only 30% of visitors surveyed at national park sites said the parks were their primary destination.

Collectively, two age groups represented more than 50% of visitors on both surveys — children ages 1–15 and adults 36–50. At least 75% of all visitors came to the parks in groups of two to four, and about 70% of those groups identified themselves as family groups, 14% as friends, and 6–10% as family and friends. Fifty-nine percent of visitors to national park sites spent less than a day in the parks, while only 28% of state park visitors reported less than a one day stay. Forty-eight percent of state park visitors reported stays of two days or longer; only 19% of national park site visitors reported stays of that duration. About a quarter of respondents to both surveys said they spent one to two days in the parks.

WHEN DO THEY VISIT?

Visitation to the parks is highest in June, July, and August when the parks have about 45% of their total annual visitation. September, October, and November account for 28% of the total; March, April, and May account for 18%; and December, January, and February account for only 9% of the total annual visitation (see appendix K).

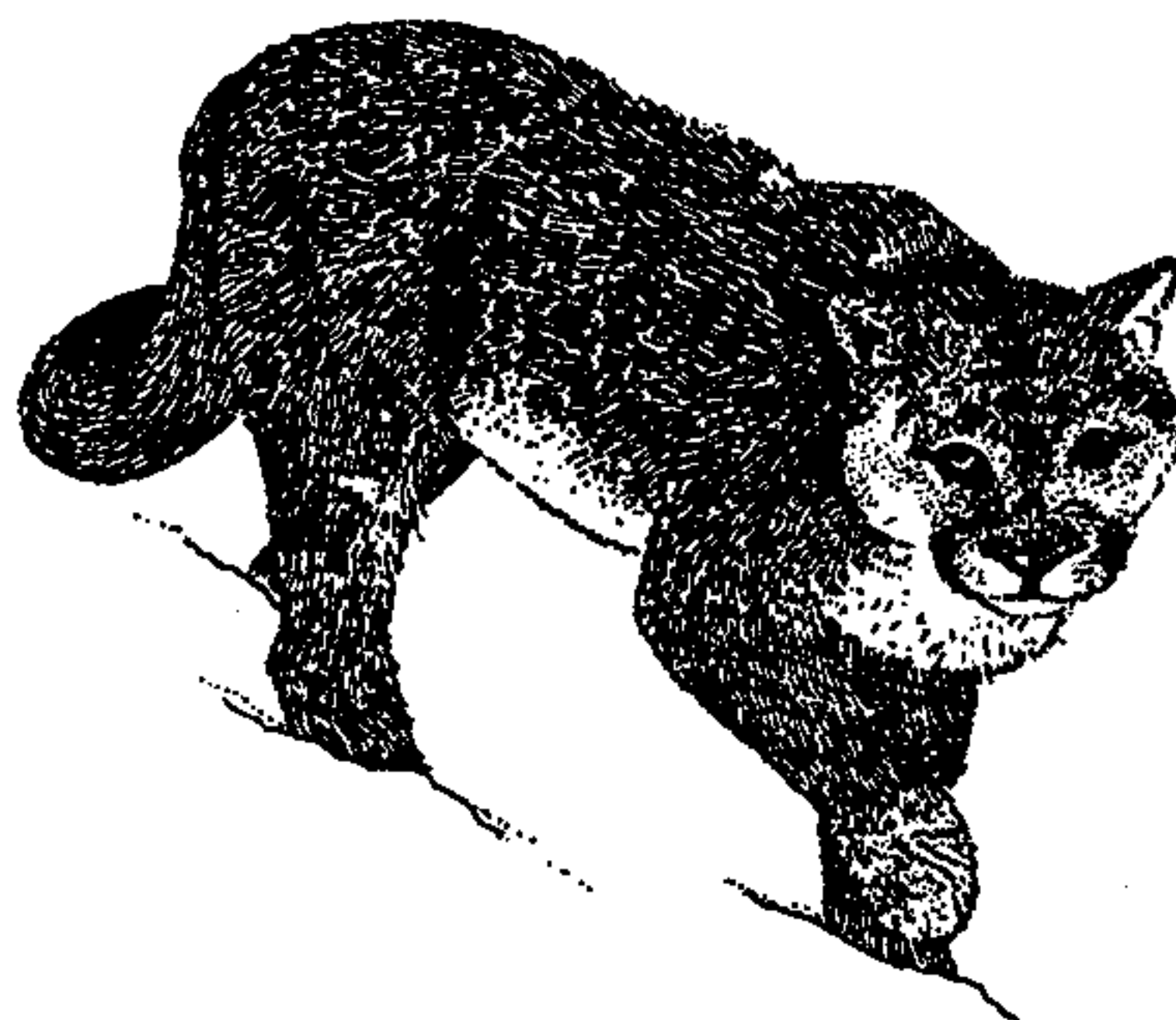
WHAT DO THEY DO?

The visitor surveys conducted in 1993 in the national park and 1995 in the state parks asked visitors why they came to the parks. More than 90% on both surveys listed “viewing the scenery” as one of the reasons they were visiting the parks. Recreation was listed by 72% of those responding in the state parks, while 41% of national park respondents listed recreation as a reason for their visit. “Viewing wildlife” was listed by 63% in the state park survey, and 47% in the national park survey. About one third of the respondents to both surveys checked “learn about history/culture,” and 45% of those responding to the state parks survey and 30% of national park survey respondents checked “solitude” as one of their reasons for visiting. The category “other” was an identified reason for visiting the parks by 11% of those responding to the national park survey and by 18% of those responding to the state park survey.

When asked which activities they had participated in during their visit, “sightseeing” was listed by about 90% of both survey groups. “Walking/hiking less than 2 hours” was the next most frequently identified activity, with about 65% of respondents to both surveys listing it as an activity in which they had participated. Other activities and the results of both surveys are listed below:

TABLE 14: ACTIVITY SURVEY RESULTS

ACTIVITY	NPS SITES SURVEY	STATE PARKS SITES SURVEY
Beachcombing	34%	48%
Bike touring	2%	3%
Camp in primitive campground	7%	4%
Camping in developed campground	22%	62%
Fishing	5%	10%
Horseback riding	1%	1%
Mountain biking	2%	7%
Picnicking	36%	42%
Rafting/kayaking	1%	8%
Ranger guided activity	11%	29%
Surfing	1%	1%
Swimming	11%	22%
Walking/hiking >2 hours	28%	45%
Wildlife/bird viewing	39%	57%



SOCIOECONOMIC PROFILE

REGIONAL CONTEXT

Several communities within the Humboldt/Del Norte County area could be affected as a result of management decisions following from the new directions contained in this joint plan. Communities that are principally affected by Redwood National and State Parks operations and visitor activities are the town of Orick in Humboldt County and the Klamath and Hiouchi communities in Del Norte County. Other communities that are affected include the cities of Arcata, McKinleyville, and Trinidad in Humboldt County and Crescent City in Del Norte County. The reservations and trust lands of several American Indian tribes are also in these two counties. These include the Yurok Reservation, which extends along the Klamath River (the lands within 1 mile of both sides of the river from the Pacific Ocean to 43 miles upstream) straddling both south-central Del Norte County and north-central Humboldt County, and the Hoopa Valley Reservation, which is along the Trinity River in north-central Humboldt County. Also, several rancherias are located in both counties.

POPULATION

Population change for the counties and cities in the affected region can be put into perspective by comparing such change with the state's population, which increased from 23.7 million in 1980 to 29.8 million in 1990 — or 25.7% for an average annual rate of growth (AARG) of 4.7%. As shown in table 15, population growth in Del Norte County was lower than the state growth rate during the 1980s, increasing from 18,217 in 1980 to 23,460 persons in 1990, for an average annual growth rate of about 2.6%. Most of the growth was in unincorporated areas. In contrast, population growth in Humboldt County was very modest, rising from 108,514 in 1980 to 119,118 in 1990 for an average annual growth rate of only 0.9%, which suggests that natural increase accounted for most of this growth during the period. As shown in the table, the population in Crescent City increased modestly

during the 1980s, increasing from 3,075 in 1980 to 4,380 in 1990, whereas the Klamath community population declined from 1,418 persons to 827 persons. Published Census population information is not directly available for the Hiouchi community. However, a recent study prepared for the U.S. Forest Service (*Well-Being Assessment of Communities in the Klamath Region, Forest Community Research*, October 20, 1997) estimated the 1990 population at 752 persons. The Hiouchi area is a bedroom community of Crescent City and appears to be growing based on observed increases in new residential construction, which is consistent with growth patterns indicated by the census data for unincorporated areas of Del Norte County. The city of Arcata and McKinleyville grew rapidly during the 1980–90 period, while the city of Eureka grew slowly and Trinidad's population declined modestly. Published Census data is also not directly available for Orick. The town of Orick is in census tract no. 102 (Northwest coastal area), which had a population of 3,204 in 1990. The population in the Orick area was estimated at 507 persons, based on the recent U.S. Forest Service study mentioned previously. Anecdotal information from local leaders in the community suggested that population in the Orick area has declined from roughly 2,500 persons in the early 1970s to about 340 persons in 1990.

Since 1990 the state and the counties in the affected region have undergone modest population growth, reflecting the general slowdown in economic activity resulting from defense cut-backs at the state level and continuing decreases in timber harvests and related manufacturing activity at the regional level. Nonetheless, there have been increases in other sectors in the regional economy, such as state and local government (particularly in Del Norte County with the opening of the Pelican Bay state corrections facility) and tourism-related activity that has stimulated the retail trade and services sectors. According to the California Department of Finance, Del Norte County had a fairly rapid rate of growth, increasing from 24,360 to 28,626 persons between 1990 and the end of 1995 or

TABLE 15: POPULATION CHANGES IN THE AFFECTED REGION^a

Location	1980	1990	1995	%Change 1980-90	AARG 1980-90	%Change 1990-95	AARG 1990-95
Del Norte County	18,217	23,460	28,626	28.8%	2.6%	22.0%	4.0%
Hiouchi Area ^b	n/a	752	n/a	n/a	n/a	n/a	n/a
Klamath CDP ^c	1,418	827	n/a	-41.7%	-5.2%	n/a	n/a
Crescent City (city limits) ^d	3,075	4,380	3,897	42.4%	3.6%	-11.0%	-2.4%
Humboldt County	108,514	119,118	125,500	9.8%	0.9%	5.4%	1.0%
Orick Area ^e	n/a	507	n/a	n/a	n/a	n/a	n/a
Trinidad	379	362	360	-4.5%	-0.9%	-0.6%	-0.1%
McKinleyville ^f	7,772	10,749	12,000	38.3%	3.3%	11.6%	2.2%
Arcata	12,340	15,197	16,000	23.2%	2.1%	5.3%	1.0%
Eureka (city limits)	24,153	27,025	27,500	11.9%	1.1%	1.8%	0.4%

SOURCE: The U.S. Census for 1980 and 1990; California Department of Finance, Demographic Research Unit; *Well-Being Assessment of Communities in the Klamath Region, Forest Community Research*, October 20, 1997; and, 1997 *Humboldt County Economic and Demographic Almanac*, North Coast Almanacs, 1997.

- a. Percentage change is based on average annual (compounded) rate of growth.
 b. The Hiouchi area is located in census tract 2 of Del Norte County. The 1990 estimate was based on aggregations of unpublished census block data.
 c. CDP refers to census designated place.
 d. Excludes Pelican Bay State Prison, which was annexed to the city subsequent to the 1990 decennial census, with a population in 1996 of 4,408 persons for a total city population of about 8,300.
 e. The Orick area is in census tract 102 of the northwest coastal subarea in Humboldt County. The 1990 estimate was based on aggregations of unpublished census block data.
 f. Estimated, based on a 1996 population estimate from the 1997 "Humboldt County Economic and Demographic Almanac" (op. cit. 1997).

22.0%. The Crescent City population (excluding the Pelican Bay Prison population) actually declined by 11.0% during the period. Information is not available on population change between 1990 and 1995 for Hiouchi or Klamath.

Population growth in Humboldt County grew at a modest rate (5.4% total) between 1990 and 1995, increasing from 119,800 to 125,500 persons and reflecting the slow transition from a timber-based manufacturing economy to a more diversified economy with tourism becoming increasingly important. The most rapid

population growth of the places evaluated occurred in McKinleyville, increasing by a total of 11.6% between 1990 and 1995. Population growth continued at a modest rate in Arcata, increasing by a total of 5.3% between 1990 and 1995. Population growth was much more modest for the city of Eureka, which increased by only 1.8% during this five-year period. The city of Trinidad declined slightly between 1990 and 1995. There are no population figures available for Orick in this period, but recent school enrollment declines indicate that community's population probably declined during the early 1990s.

AREA HOUSING

Humboldt County

Housing units have been estimated for Humboldt County and incorporated cities therein as of January 1, 1996 by the state Department of Finance. Table 16 summarizes housing information for Humboldt County, with more detailed data for Arcata and Trinidad, two incorporated communities located south of the parks. Vacancy rates are low in Arcata but high in Trinidad and the entire county. In general, incorporated city vacancy rates are much lower than the overall unincorporated county vacancy rate of 13.0%, averaging 5.3%.

Further breakout of housing data for unincorporated communities, such as Orick, is not feasible from available published information. However, based on anecdotal information, most of the existing housing stock is relatively old, with housing tenure roughly split between owner-occupied and renter-occupied. Only one or two new homes have been built since the early 1980s, although several houses have been renovated (some by the National Park Service for its personnel).

Del Norte County

Crescent City is the only incorporated city in Del Norte County, so housing unit estimates are presented for these two jurisdictions in table 17. Vacancy rates are moderately high in Crescent City and quite high for Del Norte County. Again, unincorporated areas have significantly higher vacancy rates than Crescent City.

As discussed above, housing data for unincorporated communities from published sources is generally limited. In the case of the Klamath community, however, 1990 Census housing data is available. The Klamath census designated place (CDP) had a total of 398 housing units, 213 (54%) of which were owner occupied, 94 (24%) of which were renter occupied, and 91 (23%) of which were vacant. The homeowner vacancy rate was only 1.4%, while the rental

vacancy rate stood at 8.7%. Roughly half of the vacant units were for seasonal, recreational, or occasional use.

As noted above, Hiouchi appears to be a rapidly growing community with many of the residents being well educated and earning relatively high incomes. This is reflected in high housing valuations for owner-occupied units, which are considerably above the county average. A disproportionately large share of housing units are owner occupied, some 80% of the total units.

ECONOMY

Per Capita Personal Income

Per capita personal income in Humboldt and Del Norte Counties is considerably below the California average, which was \$22,343 in 1994 (in current year dollars). For Humboldt County per capita personal income was \$18,105 in 1994. For Del Norte County per capita personal income was \$13,818 in 1994. In 1994 the share of personal income from transfer payments (i.e., income payments by governments and business to individuals and nonprofit institutions, for which they do not render current services) for the state was 16.3%. For Humboldt and Del Norte Counties these shares were much higher at 24.1% and 31.3%, respectively, indicating the relatively poor economic conditions and distressed labor markets of the two-county region.

Employment

The two-county region can be characterized as being in a state of economic transition. Employment figures by county given in tables 18 and 19, illustrate the changes taking place. The data are from the U.S. Department of Commerce, Bureau of Economic Research, and include proprietors and self-employed workers in addition to salary and wage workers covered by unemployment insurance. These counties have historically relied upon timber-based employment for direct jobs; however, timber resources have become considerably more scarce and

TABLE 16: HUMBOLDT COUNTY HOUSING ESTIMATES (AS OF 1/1/96)

Jurisdiction	Total Housing Units	Occupied Housing Units	Percent Vacant Housing Units
Total County	55,146	49,977	9.4%
Unincorporated Area	29,357	25,541	13.0%
Arcata	6,939	6,687	3.6%
Trinidad	204	173	15.2%
Other Incorporated	18,646	17,576	5.7%

TABLE 17: DEL NORTE COUNTY HOUSING ESTIMATES (AS OF 1/1/96)

Jurisdiction	Total Housing Units	Occupied Housing Units	Percent Vacant Housing Units
Total County	10,274	9,020	12.2%
Unincorporated Area	8,371	7,260	13.3%
Crescent City	1,903	1,760	7.5%

subject to much greater regulation during the past decade or so. This has reduced the emphasis on logging, forest products processing, and related activities, and this trend will very likely continue for the foreseeable future.

Humboldt County employment increased 6.6% between 1989 and 1994 as shown in table 18. Farm employment decreased modestly during this five-year period, while agricultural services, including fishing and fish processing, increased substantially. Employment in the construction and manufacturing sectors grew at below county average rates, and these sectors have declined (modestly) as shares of the county total. This reflects declines in timber industry activities, which is discussed below. Similar trends are also present in several related sectors, namely, transportation, public services, and wholesale trade, which declined in the 1989-94 period, most likely due to a reduction in timber-based product transportation and equipment purchases.

Also, mining declined to a small fraction of the employment level indicated for the earlier period. On the other hand, retail trade, the second largest sector, grew at nearly the rate for

the county average, while the (largest) services sector with more than 28% of county employment in 1994, grew at nearly triple the overall rate of 17.1% between 1989 and 1994. The smaller finance, insurance, and real estate (FIRE) sector, with 5.6% of county employment in 1994, also increased substantially more than the average rate of 13.7% between the two benchmark years. For government, employment growth overall was modest, some 3.5%; however, this result masks the details, which show substantial declines in federal civilian and military shares of the total and an above average increase in the much larger share for state and local government employees.

One of the hardest hit of the areas suffering from a decline in timber harvests and wood products manufacturing is the Orick area. There is only one remaining lumber mill out of 11 (according to a long-time local resident) that operated in the area 20-30 years ago that employed workers from Orick. As a consequence of decline in resource-based industries, e.g., logging, trucking, and wood products production, the area has experienced substantial out-migration.

TABLE 18: HUMBOLDT COUNTY EMPLOYMENT BY INDUSTRY, 1989-94^a

Industry Sector	1989 Employment	Percent	1994 Employment	Percent	Percent Change 1989-94
Farm	1,396	2.3%	1,303	2.0%	-6.7%
Non-Farm	58,298	97.7%	62,309	98.0%	6.9%
Agricultural Services and Other ^b	1,472	2.5%	2,065	3.2%	40.3%
Mining	103	0.1%	18	>0.1%	-82.5%
Construction	3,589	6.0%	3,700	5.8%	3.1%
Manufacturing	7,345	12.3%	7,582	11.9%	3.2%
Transportation, Com- munication, and Public Utilities	2,979	5.0%	2,571	4.0%	-13.7%
Wholesale Trade	2,159	3.6%	1,673	2.6%	-22.5%
Retail Trade	11,916	20.0%	12,546	19.7%	5.3%
FIRE ^c	3,153	5.3%	3,586	5.6%	13.7%
Services	15,391	25.8%	18,025	28.3%	17.1%
Government	10,191	17.1%	10,543	16.6%	3.5%
Federal Civilian	986	1.7%	847	1.3%	-14.1%
Military	844	1.4%	555	0.9%	-34.2%
State and Local	8,361	14.0%	9,141	14.4%	9.3%
Total	59,694	100.0%	63,612	100.0%	6.6%

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information Service, table CA25 and CA05.

- a. Employment and earnings by place of work; includes wage and salary and proprietor categories.
b. Includes agricultural services, forestry, and fishing, hunting, and trapping.
c. FIRE includes finance, insurance, and real estate.

TABLE 19: DEL NORTE COUNTY EMPLOYMENT BY INDUSTRY, 1989-94^a

Industry Sector	1989 Employment	Percent	1994 Employment	Percent	Percent Change 1989-94
Farm	356	4.5%	373	3.8%	4.8%
Non-Farm	7,504	95.5%	9,396	96.2%	25.1%
Agricultural Services and Other ^b	453	5.8%	655	6.7%	44.6%

Industry Sector	1989 Employment	Percent	1994 Employment	Percent	Percent Change 1989-94
Mining ^c	n/a	-	n/a	-	-
Construction	505	6.4%	406	4.2%	-19.6
Manufacturing	828	10.5%	558	5.7%	-32.6%
Transportation, Communication, and Public Utilities	320	4.1%	342	3.5%	6.9%
Wholesale Trade	95	1.2%	119	1.2%	25.3%
Retail Trade	1,624	20.7%	1,994	20.4%	22.8%
FIRE ^d	357	4.5%	465	4.8%	30.35
Services	1,776	22.6%	2,219	22.7%	24.9%
Government	1,542	19.6%	2,636	4.8%	70.9%
Federal Civilian	163	2.1%	169	1.7%	3.7%
Military	95	1.2%	80	0.8%	-15.8%
State and Local	1,284	16.3%	2,387	24.4%	85.9%
Total	7,860	100.0%	9,769	100.0%	24.3%

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, table CA25 and CA05.

- a. Employment and earnings by place of work; includes wage and salary and proprietor categories.
 b. Includes agricultural services, forestry, and fishing, hunting, and trapping.
 c. N/a refers to not available due to disclosure rules; however, estimates are included in totals.
 d. FIRE includes finance, insurance, and real estate.

As noted above, the population of Orick has declined dramatically during the past two decades. Many of the long-term residents as well as some of the newcomers who replaced those leaving have pursued a variety of occupations, such as redwood burl and wood carving and sales, beach fishing, and farming, as well as tourism-related services providers, among others. Some of these occupations are resource-dependent, albeit not as intensive and highly organized as in traditional (timber-related) industries. Nonetheless, these occupations are associated with lower wages than earned in traditional resource-dependent industries. Thus, relatively low wages earned in these occupations, combined with high unemployment (17% of the labor force in 1989) as well as a high

proportion of occupied housing being comprised of single-parent families with children less than 18 years of age have contributed to a relatively high poverty rate in Orick (22% in 1989 compared to 18% for Humboldt County and 14% for the state of California).

Del Norte County employment grew more rapidly overall than Humboldt County employment (although from a much smaller base) for a 24.3% increase, as shown in table 19. Construction and manufacturing both declined. In contrast, growth was strong in the retail trade, services, and FIRE sectors. State and local government employment grew most at 85.9% and accounted for more than half of the overall county increase in employment during the

1989–94 period. This was due to expanded operations at the state prison at Pelican Bay.

Note that California employment declined by about 1.3% over the 1989–94 period. Major declines were in the construction and manufacturing sectors due to recessionary conditions during much of the period owing in part to military and aerospace cutbacks in response to defense spending cuts.

The level of unemployment in Humboldt County at 8.3% is near the average for the state, which in 1994 amounted to 7.8% of the labor force. For the year 1996 (through November) the unemployment rate in Humboldt County dropped to 7.7%. Del Norte County's unemployment rate was substantially higher at 12.3%.

Timber Harvest Declines

The lumber and forest products industries of California's north coast has been centered in Humboldt County, which has traditionally led California counties in timber harvesting. Historical data are available (Martin O'Connell Associates 1991) on timber harvest in million board feet (MBF), which for Humboldt County exceeded 1 billion board feet for all years 1952–74. Following 1974 there was a downward trend generally until the mid-1980s, at which time there was a brief period of resurgence. The early 1970s harvest of more than 1 billion board feet had slid to a bit less than half a billion board feet by the early 1990s. Employment changes in manufacturing, which consist primarily of activity in the lumber and wood products industries, provide another indicator of the decline in the influence of forest products in the region. This was noted above in reference to the Orick area in the northern portion of the county.

According to the same source, total manufacturing employment in Humboldt County declined from 10,413 jobs in 1969 to a low of 5,855 jobs in 1982 before turning around and increasing slowly to 7,582 jobs in 1994. During the 1980s when the decline in manufacturing employment was most pronounced, lumber and wood products industry employment (which represented

about 75% of the total manufacturing employment) decreased from 5,400 jobs in 1980 to 4,900 jobs in 1989 or 9.3% in Humboldt County. The decline in the forest products industry was also felt in Del Norte County where a corresponding employment loss occurred in lumber and wood products manufacturing, but this decline was much more severe — from 1,450 workers in 1980 to about 500 workers in 1989 or 65.5%.

Commercial Beach Fishing

Commercial beach fishing is a relatively small but important component of the commercial fishing industry in the north coast region. According to the *1997 Humboldt County Economic and Demographic Almanac*, published by North Coast Almanacs, for the Eureka area, which runs from Fort Bragg to Crescent City, the total commercial fishing industry landings in 1995 amounted to 52.5 million pounds (total commercial catch of finfish), with a wholesale value estimated at about \$35 million. NPS information on commercial beach fishing for smelt and surfperch from Crescent City to Fields Landing in Humboldt County, which is based on California Department of Fish and Game (CDFG) statistics, indicated port landings of 2.0 million pounds with a wholesale dollar value of \$700 thousand in 1995.

A major portion of the port landings of smelt and surfperch were caught in the immediate vicinity of the parks. The smelt catch is comprised of night smelt, surf smelt, true smelt, whitebait, and silversides. Surfperch includes redbait, barred, shiner, walleye, white, rubberlip, pile, and rainbow surfperch. The catch of fish reported by the state Department of Fish and Game originating from block 120, which extends from just above Mussel Point (north of the mouth of Redwood Creek) to Split Rock (south of the Klamath River, or essentially all of Gold Bluffs Beach), amounted to 1.4 million pounds. The catch of fish originating from block 126, which extends from the south end of Big Lagoon north to Mussel Point (and includes the two major surf smelt fishing areas of Stone Lagoon Beach, which is in Humboldt Lagoons State Park, and Freshwater Lagoon Beach, which is in the RNSP

boundary) was a much smaller figure at 74,000 pounds. In addition, a relatively small amount of fish caught along the beach within these areas may be reported as originating in block 1041, which is offshore. The total reported catch of fish from that block amounted to about 15,000 pounds in 1995.

Detailed historical data on smelt and surfperch catches at Gold Bluffs Beach and in the vicinity of Redwood Creek covering the period 1980–96 are also reported by the State Department of Fish and Game. The average annual smelt catch at Gold Bluffs Beach amounted to about 205,000 pounds with an estimated value of about \$72,000. For surfperch the average annual catch amounted to about 2,400 pounds with an estimated value of about \$2,400. The corresponding average annual figures for Redwood Creek were 23,000 pounds of smelt with a wholesale value of about \$8,000 and 150 pounds of surfperch with a value of approximately \$149. Thus, the combined value of the two fisheries amounted to approximately \$82,500 per annum on average.

Commercial beach fishing is subject to CDFG regulations and permitting requirements. However, the California Department of Parks and Recreation currently allows access to Gold Bluffs Beach for commercial beach fishing by permit only. CDPR-issued permits are limited to the number of existing permit holders. In 1995 there were 57 permit holders: 20 of these 57 were residents of Orick and 19 were from the Arcata/Blue Lake/McKinleyville area.

Tourism Growth

It is perceived that most visitors to the region either come to see the redwoods or are passing through while traveling along the west coast between any of a number of origins and destinations, both north and south. The visitor industry is seasonal, with most travel during warmer/drier months. Also, recreational fishing is a significant draw, probably second to the redwoods as a tourism attraction for travelers with a California north coast destination.

RNSP visitor data also give an indication of level and growth of visitation to the region (refer to the following section on "RNSP Visitor Use" for more detail). Total NPS visitation data are available from 1970 shortly after the national park was established. Visitation climbed from 28,042 in 1970 to 269,717 in 1980, after which it grew more slowly to 348,458 in 1990. Visitation continued to grow to 552,464 in 1995, thereafter falling back to 427,712 visitors in 1996. CDPR visitation figures are tabulated separately. The most recent available figures are for July 1996 through June 1997 when total visitation to the (three) state parks was recorded at 588,710 visitors.

These data reflect considerable growth, but one should understand that the data reflect the possibility of double counting the total number of people coming to the area because whenever visitors appear at more than one collection point or more than once at any given collection point they are counted.

Hotel/motel room revenues are an indicator of tourism to the region and have been estimated in the "1997 Humboldt County Economic and Demographic Almanac" (Lammers 1997). These revenues have been estimated from records on transient occupancy tax revenues. The tax rate is 8% of accommodations cost for Eureka, Fortuna, and all unincorporated areas, but 10% in Arcata. Total hotel/motel room revenues in Humboldt County amounted to \$8.2 million in 1980 (fiscal year 1980–81) growing to \$14.9 million in 1985, for an average annual rate of growth (AARG) of 10.2%. By 1990 these transient accommodations revenues had grown to \$22.6 million, for an average annual rate of growth of 2.4%. In the 1990s revenues continued to increase, but at a more modest rate with revenues at \$24.4 million by 1995 (fiscal year 1995–96), for an average annual rate of growth of 1.5%. These figures suggest that growth in tourism peaked in the early 1980s and, after more gradual increases through 1990, was slight for the period 1990–95. Although motel/hotel room revenues and related tourism growth in Del Norte County were not evaluated, the experience was probably very similar to that of Humboldt County.

According to the California Division of Tourism (*California Tourism Research, County Travel Impacts*, 1996), travel expenditures and related jobs amounted to \$130.9 thousand and 1,680 jobs in Del Norte County and \$318.5 thousand and 4,100 jobs in Humboldt County in 1996. These magnitudes represent a small fraction of total California tourism activity, which accounted for \$56.7 million in travel expenditures and 630.4 thousand related jobs.

A 1990 study by Grossman Design Group, *Overnight Accommodations Study, Del Norte County and Crescent City, Volume I*, lists three deterrents to tourism development in the area. The first two of these are access and weather. Freeway access is not available. Air access is limited by airport closures due to weather. Weather in the area is not as consistently good as in other California and Oregon tourist destinations. The third deterrent is the lack of adequate tourist infrastructure.

A recent consultant study reviewing the proposed Yurok lodge assessed the local market for additional lodging opportunities. The study, *Yurok Lodge Project Review and Pre-Architectural Programming/Feasibility Scoping* (prepared by Market Value Planners, August 12, 1996) indicates that opportunities for roadside motel development are very limited. New construction of motor lodge facilities in Crescent City and Fortuna has caused demand for these accommodations to be spread more thinly than before. Survey data for the past five years indicate a very competitive lodging market with small increases in room rates. Current annual occupancy rates in the area are about 55%, with average room rates in the \$38-\$78 range.

The Yurok lodge study notes that the Humboldt and Del Norte County area is a major scenic route with no significant destination attractions. Distance and weather are seen as limiting visitor activity to warmer months. The study indicates that 59% of the visitors remain in the area less than one day. The average length of stay for all visitors is 2.1 days, shorter than the California average of 2.9 days.

RNSP VISITOR USE

Overview

As noted in the previous section, historical data are available from both the National Park Service and the California Department of Parks and Recreation on visitation to the parks. Table 20 presents data on visitation to Redwood National Park between 1970 and 1996 based on NPS monthly public use statistics. The data refer to counts of total visits as well as visits to two popular locations (Lady Bird Johnson Grove and Redwood Creek Trail) and at the major RNSP information centers. Visitation data provided by the California Department of Parks and Recreation are presented for the period 1987 through June 1997. The latter are presented in terms of total visitors and camping visitors for each of the three state parks (see table 20). (It is important to note that with the exception of overnight visitors at campgrounds, CDPR data on visitation are not incorporated in the analysis of historical visitation trends for purposes of this joint plan. It was felt that most visitors to the state parks would be included in the NPS visitation figures and, therefore, excluding them would avoid likely duplication. The inclusion of overnight camping visitors, however, appears warranted, as many are repeat visitors whose interests are principally in pursuing recreation opportunities available specifically within the state parks.)

It is important to note that the NPS data reflect the possibility of double counting whenever a visitor appears at more than one collection point or more than once at any given collection point. (The problem of duplication of visitor counts would be compounded if the CDPR data on visitation at state parks were included, with the exception previously noted with respect to overnight camping visitors.) Even so, the raw data from which the counts were generated have been adjusted (by dividing the totals by two) to reflect single entry into the parks and at least two stops

TABLE 20: REDWOOD NATIONAL AND STATE PARKS, NPS MONTHLY PUBLIC USE STATISTICS 1970-96

Year	Total Visits	Lady Bird Johnson Grove	Redwood Creek Trail	Redwood Information Center ^a	Crescent City Information Center	Hiouchi Information Center
1970	28,042	N/A	N/A	22,856	2,961	—
1971	34,500	2,031	1,490	N/A	N/A	—
1972	52,152	9,803	1,421	33,243	7,434	—
1973	105,246	14,201	1,449	41,072	9,608	—
1974	164,151	13,657	2,117	41,495	17,181	—
1975	195,503	16,157	5,219	43,547	18,583	—
1976	221,165	14,747	7,000	50,387	27,841	7,419
1977	255,372	32,473	11,776	50,006	35,316	13,846
1978	256,705	36,861	10,313	55,553	37,094	17,886
1979	240,182	29,520	14,320	44,790	24,608	14,393
1980	269,717	30,725	17,325	55,140	26,831	33,379
1981	316,409	31,241	16,503	64,749	24,958	35,058
1982	274,718	26,347	14,938	55,275	27,203	33,049
1983	277,389	23,078	14,067	50,892	26,253	40,822
1984	273,392	30,896	6,142	60,073	24,613	31,038
1985	338,830	34,156	7,175	77,056	29,233	21,836
1986	339,275	35,309	6,769	121,600	38,075	30,102
1987	365,450	33,167	6,265	140,727	25,734	36,528
1988	356,230	33,691	6,313	139,091	39,449	43,689
1989	327,058	27,479	12,792	131,555	42,924	49,737
1990	348,458	36,050	13,063	120,647	43,368	58,259
1991	366,280	36,593	11,145	137,254	54,745	52,335
1992	387,781	31,389	28,215	126,310	38,791	54,721
1993	427,365	32,974	6,736	149,616	33,641	56,921
1994	475,033	37,937	14,729	160,415	32,452	48,701
1995	552,464	42,606	12,349	166,741	45,630	47,441
1996	427,712			173,532	44,370	34,768
AARG 1970-96	11.1%	12.4%	8.5%	8.2%	11.0%	—
1976-96	—	—	—	—	—	8.0%
1986-96	2.3%	2.2%	5.6%	3.6%	1.5%	4.6%

Source: NPS monthly public use statistics, various years.

a. Before 1985 visitor information services were provided at the Orick ranger station.

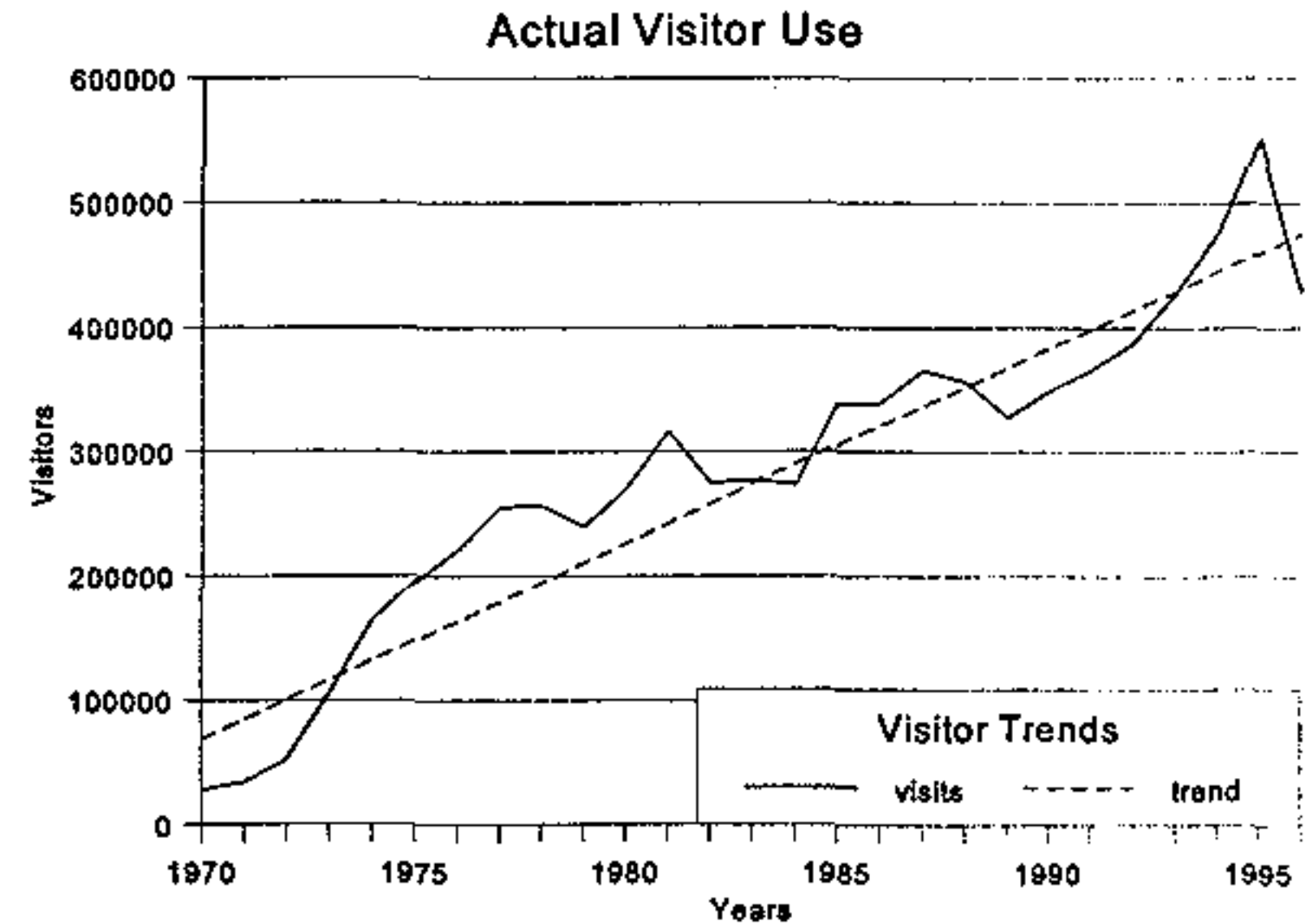
for which counts would have been made. If more than two stops occurred, then there would be the possibility of double counting.

As shown in table 20, the average annual rate of growth (AARG) calculated over the entire period is high at 11.1%. Growth during the recent 10-year period — 1986 through 1996 — was much lower at a 2.3% average annual rate of growth. Similar patterns are shown for the interior RNSP locations — Lady Bird Johnson Grove and Redwood Creek Trail — with average annual rates of growth ranging between 8.2% and 12.4% from 1970–96. Lower rates of growth occurred during the most recent 10-year period at 2.2% and 5.6% for these two locations, respectively. Growth in visitation at the information centers ranged from 8.0% to 11.0% (AARG) during 1970 through 1996 and from 1.5% to 4.6% (AARG) during the most recent 10-year period. (Note that the Hiouchi information center began operations in 1976.)

Regression analysis (a statistical technique used to establish the linear relationship between the number of visitors and time) was performed to establish the long-run growth trend in RNSP visitor use (see figure). The results indicated that visitor use increased by about 15,400 visits for each year, which translates to an average annual rate of growth of 2.5%. The figure indicates actual visits by year and the linear trend that resulted from estimating the relationship between the variables (visits and units of time).

Table 21 presents total visitors and camping visitor attendance (which are included in the totals) for each of the three state parks as well as summations of the visitation data for the 10-year period between 1987 and 1997, based on CDPR visitor counts. As shown in the table, the counts indicating total visitors for all three state parks actually decreased over the period, or -3.5% per year on average. The rate of decrease was slightly less during the period 1990–97 at -2.3% per year. However, total camping visitors at the three parks remained essentially constant over the entire period 1987–97. Between 1990 and 1997 the number of visitors increased modestly for an average annual rate of growth of 1.8%.

Redwood National and State Parks



As noted previously, total visitation at the parks is calculated by adding the number of visitors implied from the trend line constructed from NPS data (shown in table 20), which for 1996 amounts to about 480,000 visitors, and the number of overnight visitors at state park campgrounds (as shown in table 21) or about 145,000 visitors in 1996 (which is based on the average of the 1995–96 and 1996–97 visitor counts shown in the table). Total RNSP visitation in 1996, therefore, is estimated at 625,000 visitors. The 1996 year total is used as the initial point for developing forecasts of RNSP visitation for the purposes of projecting impacts of visitor use under the various alternatives. The RNSP visitation forecasts are presented in the “Environmental Consequences” section of this document.

Freshwater Lagoon Spit Users

Numerous RV users and tent campers overnight at Freshwater Lagoon Spit at the south end of Redwood National and State Parks. Although most stay overnight or for a few days at a time, during the summer months and especially during periods when beach fishing is excellent many stay for a week or longer. NPS regulations prohibit stays longer than 15 days for a single stay and 30 days total in a calendar year.

Information collected by NPS volunteers in an informal survey during the month of August

TABLE 21: REDWOOD NATIONAL AND STATE PARKS CDPR VISITOR STATISTICS 1987-97

Year	Total State Park Visits ^a	Total Camping Visits	Del Norte Coast Redwoods Total	Del Norte Coast Redwoods Camping	J. Smith Redwoods Total	J. Smith Redwoods Camping	Prairie Creek Redwoods Total	Prairie Creek Redwoods Camping
1987	844,833	146,752	86,515	42,648	173,648	50,114	584,670	53,990
1988	837,518	137,112	68,520	36,701	155,212	53,428	613,786	46,983
1989	778,105	141,105	57,362	35,617	170,900	51,557	549,843	53,931
1990	695,503	133,548	66,428	39,667	151,092	49,733	477,983	44,148
1991	710,162	122,685	67,677	36,753	112,847	35,259	529,638	50,673
1992	613,609	141,222	75,022	38,178	141,392	51,455	397,195	51,589
1993	766,309	148,692	83,490	43,301	182,471	54,422	500,348	50,969
1994	677,221	149,436	102,381	49,701	195,520	53,643	379,320	46,092
1995/96	538,530	138,754	70,685	29,184	180,509	51,960	287,336	57,610
1996/97	588,710	151,389	98,405	36,427	305,048	51,853	185,257	63,109
AARG: 1987-94	-3.1%	0.3%	2.4%	2.2%	1.7%	1.0%	-6.0%	-1.7%
1987-97	-3.5%	0.3%	1.3%	-1.6%	5.8%	0.3%	-10.9%	1.6%
1990-97	-2.3%	1.8%	5.8%	-1.2%	10.6%	0.6%	-12.7%	5.2%

SOURCE: California, Department of Parks and Recreation, Visitor Attendance for North Redwood Parks, Period January 1987 through June 1995 (special computer run); FY Total Visitor Attendance Reports July 1995—June 1996 and July 1996—June 1997.

a. Visitor counts beginning 1995/96 run from July 1 through June 30; visitor counts for previous years reflect annual calendar totals.

1996 on a Thursday (August 22) and a Sunday (August 25) provided useful insights regarding visitor use at Freshwater Lagoon Spit. The vehicle count for Thursday stood at 70 vehicles, including RVs, campers, vehicles with trailers, and fifth-wheelers, increasing to approximately 80 vehicles on Sunday; however, there were 15-20 newcomers, including replacements for those who were at the spit on Thursday and subsequently departed. With an average of 2.2 persons per vehicle, there were 150-175 visitors at Freshwater Lagoon Spit during the times indicated. (Counts of 125 vehicles or more have been made at peak times.) The vehicle counts and visitor figures are probably about average for the summer months.

Occupants of about one-third of the vehicles were contacted by the volunteers, and information was elicited on a variety of questions regarding trip origin; purpose of stay; length of stay; frequency of visits; and the amount and distribution of purchases made by community within the region. Most people contacted (about two-thirds) were residents of southern California. Also, about two-thirds of the people contacted were traveling in a southbound direction via U.S. Highway 101 from Oregon or U.S. Highway 299 from northern California. The remainder were northbound on U.S. Highway 101. The primary reasons given for stopping at the spit were: free camping, convenient to the parks, and miscellaneous (with family gatherings and beach

fishing figuring prominently in the decision to stop). If unable to remain overnight at Freshwater Lagoon Spit, about a quarter would not stop in the area; a slightly lower share would stay at a campground in Orick if space were available; and the remainder would seek campground space at other locations in the vicinity.

Overnight stays ranged from one to 21 nights, and the average length of stays at Freshwater Lagoon Spit amounted to 6.7 days. The majority of persons contacted (about 75%) had been to Freshwater Lagoon Spit on previous occasions. They indicated an average of 5.2 prior visits. Purchases made by Freshwater Lagoon Spit users were for motor fuel, groceries and other provisions, propane gas, sporting equipment and amusements, handicrafts and gifts, books and maps, and RV holding tank pumpout. Average expenditures made by visitors during the course of their stays amounted to \$155. Slightly more than half of the purchases were for groceries and other provisions. Motor fuel purchases contributed about one-quarter of the total, with the remainder comprised of purchases of sporting goods and equipment at 7%, propane gas at 6%, and handicrafts at 5%. Tank pumpout expenditures were minor at about 3% of total purchases. The town of Orick accounted for half of the total purchases.

The share of purchases made by Freshwater Lagoon Spit users in Arcata/Eureka was also substantial at 20% of the total. McKinleyville and Trinidad accounted for 13% and 12%, respectively. The town of Klamath and Crescent City received small relative shares at 4% and 2%, respectively, of the total purchases.

RV camping at Freshwater Lagoon Spit represents a sizable component of total RV camping activity in the RNSP vicinity. Between Trinidad in the south and Klamath/Requa turnoff in the north, there are about 19 private RV campgrounds with approximately 872 spaces with RV hookups and 383 tent sites available for visitors. (The numbers reflect the RV parks and campgrounds that advertise their services or are listed in the regional telephone directory.) This is considered to be in the market service area in

which many Freshwater Lagoon Spit users could obtain services and find desirable amenities in the event that space were unavailable at that location. Telephone contacts were made with most of the RV campground operators in an effort to determine the available capacity and occupancy rates. The telephone interviews took place in October 1997. The information on capacity and occupancy refers to conditions in 1997.

Eight of the campgrounds are in the Trinidad area with 329 RV spaces with hookups and 72 tent sites. During the peak summer season occupancy is estimated by the campground operators at about 70%. Only one RV campground is available in Orick, with a modest number of spaces (13 RV parking spaces; no tent camping spaces) that are fully occupied during the summer. There are 10 RV campgrounds in the Klamath area (four recently closed due to flood damage) with about 530 RV spaces with hookups and 311 tent sites. (Fluctuations in RV and camping site capacity are likely, with recent figures as high as 1,600 sites in the Klamath area, based on anecdotal information.) During the summer occupancy is about two-thirds of capacity. For all of the RV campgrounds the fall, winter, and spring seasons (with the exception of several days during the earlier part of September and latter part of May) occupancy rates are very low — ranging from zero (for facilities that are closed) to about 25% of capacity.

AMERICAN INDIAN TRIBES

Lands in Redwood National and State Parks include part of ancestral territories of three tribal groups — the Tolowa, the Yurok, and the Chilula. The Chilula no longer exist as an organized tribe; the remnants became part of the Hupa, who now live east of the parks. There are eight American Indian governments operating in the general vicinity of the parks: the Yurok Tribe, whose aboriginal territory includes all of the southern and central portions and extends into the northern portion of RNSP lands, the Hoopa Valley Tribe, the Smith River Rancheria of California, the Elk Valley Rancheria of

California, the Tolowa Nation, the Coast Indian Community of Yurok Indians of the Resighini Rancheria, Big Lagoon Rancheria of Smith River Indians, and Cher-Ae Heights Indian Community of the Trinidad Rancheria. Of these, one, the Tolowa Nation, is not federally recognized.

The Yurok Tribe is associated with the Yurok Indian Reservation, located in Humboldt and Del Norte Counties. The reservation is bisected by the Klamath River and extends about 1 mile on each side between the confluence of the Klamath River and the Trinity River and the Klamath's mouth on the Pacific Coast, a distance of about 40 miles. The coastal part of the reservation overlaps with Redwood National and State Parks. According to the *Yurok Overall Economic Development Plan, Fiscal Year 1996-97*, the reservation land base consists of 56,903 acres of which the overwhelming majority (43,008 acres or 75%) is in fee ownership by others. Tribal and allotted acreage totals 13,640 acres. These acreages will increase through time as the tribe continues to buy back property.

Other public and fractionated ownership amounts to only 255 acres. The Yurok Tribe has an enrollment (nondeceased) of about 3,475 persons, of which 2,545 are in the so-called prime service area and 932 outside. The 1990 census places 1,347 American Indians on the Yurok Reservation at the time of the census. The total labor force in 1996 was given in the plan as 1,683 workers including 421 employed workers, 912 unemployed workers (1,159 unemployed workers, if persons not actively seeking employment are included), and 106 underemployed workers. The share of unemployed workers is 54% if only those persons actively seeking employment are included, and 69% if all unemployed workers are included. Tribal business enterprises indicated included forestry and other timber-sales related, commercial fisheries, Salmon Festival, and Energy Trust Fund. Casino gambling is another fast-growing business for some tribes.

PUBLIC SERVICES AND INFRASTRUCTURE

Information on public services and infrastructure is provided for several local government entities in the Redwood National and State Parks region. Most information is for Crescent City in Del Norte County at the northern portion of Redwood National and State Parks and the cities of Arcata and Trinidad in Humboldt County near the southern end of the parks. Additional information is presented on the county governments because RNSP lands and most RNSP-related facilities are in unincorporated portions of both Humboldt and Del Norte Counties. Unfortunately detailed information on the three communities that are considered to be principally affected by RNSP operations and visitor activities, Orick in Humboldt County and Klamath and Hiouchi in Del Norte County, is unavailable because they are in unincorporated areas of the counties. Nonetheless, an effort is made to characterize these areas in terms of public and private services available to visitors, based on interviews conducted in the area and observation of local conditions.

Humboldt County

The Humboldt County seat is in Eureka. The Sheriff's Department has 99 positions. The ratio of uniformed police protection officers per 1,000 population for the county was about 1.8 in 1995. Ambulance service in the area is provided by two companies. There are five hospitals in the county. Water and sewer facilities in unincorporated areas are provided by community districts as well as private systems.

Humboldt County has a zoning ordinance with numerous zoning categories. For instance, Humboldt County has inland zones for timberland preserve, forestry-recreation, two agricultural classes, several residential classes (suburban, one family, two family, multiple family, and apartment-professional), several commercial/business/industrial classes, and several recreation classes. The coastal zones include residential (multiple family, mixed,

single family, and rural residential), public facility (with separate urban and rural designations), public recreation, agriculture exclusive, coastal commercial timberland, timberland production, natural resources, and several classes of commercial (including commercial recreation) and industrial lands.

Residential building permits issued by Humboldt County government in 1995 amounted to 506 units (Lammers 1997), which was the lowest since 1984. In 1980 the figure was 377 units with the peak year occurring in 1990 at 875 units. Of the permits issued in 1995, 406 were single-family units and 100 were multifamily units.

There are 32 school districts in Humboldt County. Total enrollment for all districts amounted to 22,104 pupils in the 1996–97 school-year. Higher education is provided in the county by Humboldt State University and College of the Redwoods. The number of students enrolled at the university was 7,686 in 1996; for the college (Eureka campus only) the enrollment was 4,881 students. (Information from Humboldt County Office of Education, fax communication, February 14, 1997.)

Total public spending by Humboldt County for fiscal year 1996–97 was budgeted at \$158.9 million. The largest source of revenue is intergovernment, namely, state and federal government distributions and subventions at \$107.9 million. Federal payments in lieu of tax contributions were budgeted at \$530,059 in fiscal year 1996–97. These payments are to compensate local governments for lost tax revenue due to federal land acquisition programs. Taxes and service charges are the next largest revenue sources at \$19.9 million and \$13.9 million, respectively. The major source of tax revenue is the property tax. Tax collections from the property base were budgeted at \$10.7 million, which represents about half of the total county tax revenues. The basic sales tax is the next largest revenue source at \$2.2 million budgeted for the 1996–97 fiscal year. The transient occupancy tax and sales taxes on transportation added \$2.0 million to the total generated from sales transactions.

There are numerous special districts under the jurisdiction of the County Board of Supervisors. These include three fire districts and two flood and drainage districts. In addition there are several other special districts, including the Orick Community Services District, that are governed through locally elected boards.

There are U.S. Coast Guard operations in Eureka and Crescent City that handle most of the ocean rescues and emergency evacuations from the parks. The U.S. Coast Guard Air Station at the Eureka-Arcata airport operates helicopters that are used for land and ocean rescues.

City of Arcata

Arcata is about 25 miles south of Redwood National and State Parks. The Arcata-Eureka Airport is about 8 miles north of the city. As home of Humboldt State University (the northernmost branch of the California State University system), the city has the ambience of a cultural center. The Arcata Plaza provides a central focus to the city with numerous historic buildings, interesting shops, restaurants, etc.

The city's police department has 30 full-time and 11 part-time paid uniformed and nonuniformed personnel and 27 volunteers and reserve officers. The fire department has 14 paid and 48 volunteer firefighters. Ambulance services are provided by a private company that operates four ambulances, with two ambulances always on duty. The company has a staff of 18 — 15 are paramedics and three are emergency medical technicians. The company provides service beyond the city limits, including the area north to the Humboldt County border along U.S. Highway 101. The Mad River Community Hospital is in Arcata.

According to an information brochure produced by the Arcata Chamber of Commerce titled *Arcata, On California's Scenic Redwood Coast*, there are three full service hotels, seven motels, three bed-and-breakfast establishments, one lodge, and three RV parks in the area (including McKinleyville and Trinidad). Twenty-eight restaurants are also listed. Both lodging

accommodations and restaurants are low- to medium-priced.

City of Trinidad

Trinidad is about 10 miles north of Arcata. The principal historical basis for the city is fishing. It is located at a natural harbor that provides an excellent place to launch fishing vessels and a refuge from storms. The beautiful location and continuing presence of fishing is also an attraction for artists and tourists. The city has a small police department with a salaried full-time chief and three reserve officers. The fire department has a chief and an assistant on stipend and six to seven volunteer firefighters and emergency medical services (EMS) personnel. The department has one fire engine and one ambulance.

Two bed-and-breakfast operations in town provide accommodations to visitors; both cater to high-end of the lodging market for the region. There is also a motel offering medium-priced rooms. There are at least 11 other lodging places in and near Trinidad.

The Orick Community

The Orick community is at the south end of Redwood National and State Parks about 37 miles north of Arcata on U.S. 101. The community is in an unincorporated portion of Humboldt County. Employers in Orick include the Arcata Redwood Company, which recently operated a single shift at its lumber mill; a construction company; a logging contractor, a logging truck company; and various tourism-related establishments, including several redwood burl and wood carvers, three motels, four restaurant/cafe/tavern establishments, an RV park with a limited number of spaces for overnight users, two gas stations (with one of these likely to close), an assortment of visitor attractions, and several gift or curiosity shops. In addition, there are several farms in the immediate vicinity. There is also a K-8 elementary school (with 67 pupils enrolled for the 1996-97 school year), two churches, a community hall, and a two-bay fire hall. The latter shelters three fire vehicles and one emergency medical

services van. Municipal services are provided by the Orick Community Services District and the Orick Volunteer Fire Department and by Humboldt County.

Orick is used extensively by travelers passing through the area as a place to purchase fuel and provisions (especially by RV users). The town's merchants also benefit from purchases made by RV users and campers at Freshwater Lagoon Spit, which is a few miles south of town at the southern entrance of Redwood National and State Parks. As noted above, during the summer there are 70 or more campers, vehicles with trailers, and fifth wheelers at Freshwater Lagoon spit; most remain for several days (some as long as two weeks). A high proportion (perhaps 50%) of the people making overnight stays at Freshwater Lagoon Spit purchase goods and services in Orick.

Del Norte County

The Del Norte County seat is in Crescent City. The Sheriff's Department has 42 positions excluding the jail unit. The ratio of uniformed police protection officers per 1,000 population for the county was about 1.0 in 1995. Ambulance service is provided by a private company in Crescent City. There are six ambulances. There is one hospital, Sutter Coast Hospital, and a clinic, Center Coast Health Care, which offer urgent care services in the county.

Water and sewer facilities in unincorporated areas are provided by community districts and private systems. There are four fire districts in the county including the Klamath, Fort Dick, Crescent, and Smith River Fire Protection Districts. According to the *1996/1997 Del Norte County Overall Economic Development Program*, the county government operates the only solid waste landfill in the county. This system is operated in conjunction with transfer stations in Klamath and Gasquet. The landfill is currently at capacity and under a cease and desist order by the Water Quality Control Board. The problem is being addressed by the city of Crescent City and

Del Norte County under a joint powers agreement.

Del Norte County has a zoning ordinance with various zoning designations for coastal and noncoastal areas. For instance, the county has noncoastal zones for public ownership, timberland preserve, several agricultural classes, numerous residential classes, several commercial/business/ industrial classes, and several recreation classes. Substantial portions of the county is in public ownership, in forest recreation status, and in timberland preserve status. Most residential land is rural in character.

There were 97 residential building permits issued by the Del Norte County government in 1995. Of the permits issued, 55 were single-family units and 42 were multifamily units.

Del Norte County has a unified school district. Total enrollment for the district amounted to 5,478 pupils in the 1996-97 school-year (Humboldt County Office of Education provided pupil counts for both Del Norte and Humboldt Counties via fax, February 14, 1997). Higher education is provided in the county at the College of the Redwoods at the Crescent City Campus.

Total spending by Del Norte County for fiscal year 1996-97 was budgeted at \$40.5 million. The largest source of revenue is intergovernment, namely state and federal government distributions at \$21.7 million. Federal payments in lieu of taxes were budgeted at \$43,100 in fiscal year 1996-97. Taxes and service charges are the next largest revenue sources at \$6.1 million and \$4.9 million, respectively. The major source of tax revenues is the sales tax at \$3.8 million, followed by the property tax at \$1.8 million.

Similar to Humboldt County, there are several special districts under the jurisdiction of the County Board of Supervisors. These include four county service area bond redemption and operating fund districts, one street bond redemption district, four flood control districts, and the Klamath Community Service District. In

addition there are numerous special districts governed through locally elected boards.

Crescent City

As noted in the section on population, Crescent City has an estimated population of 8,305 including 4,408 inmates at Pelican Bay State Prison, which is 7 miles north of town. (The area where the prison is has been annexed by the city, although it is separate from the main incorporated area.)

The Crescent City Fire Department has a paid chief and 25 volunteers, and the Crescent Fire Protection District has a paid chief and 30 paid personnel. This department serves the city and an area 5 miles north of the city limits. The city has 16 police department personnel.

Crescent City relies on rainwater collectors and the Smith River for water supply. Water use relies on a 10-inch line and a 1 million gallon storage tank and averages about 2.5 million gallons per day. On some days there are shortages. The city is planning to upgrade to a 24-inch line and a 3 million gallon storage tank, which will double system capacity. Water is currently being restricted to a few hookups a year. The city also operates a sewer utility, which is adequate to handle current needs, although during some periods the system operates at or above its biological capacity. The system has a dry weather flow capacity of 1.89 million gallons per day.

The nearest airport serving Crescent City is the Del Norte County Airport — a small general aviation airport northwest of the city that has direct flights to San Francisco and connecting flights through Arcata to Sacramento. It also has charter service and a full-time fixed base operation. (The Eureka-Arcata Airport near McKinleyville is about 70 miles south on U.S. Highway 101.)

A wide variety of commercial services include privately operated facilities such as restaurants, grocery stores, hotels/motels, etc., which are used by visitors and in some cases by residents.

According to *The Key to Del Norte County*, May 18, 1996 (a newspaper devoted to information on visitor services) there were 952 motel rooms, 30 hostel beds, 2,455 privately owned RV sites, 298 privately owned tent sites, and 362 RV and tent sites in public parks in Del Norte County, most of which were in Crescent City.

The Hiouchi Community

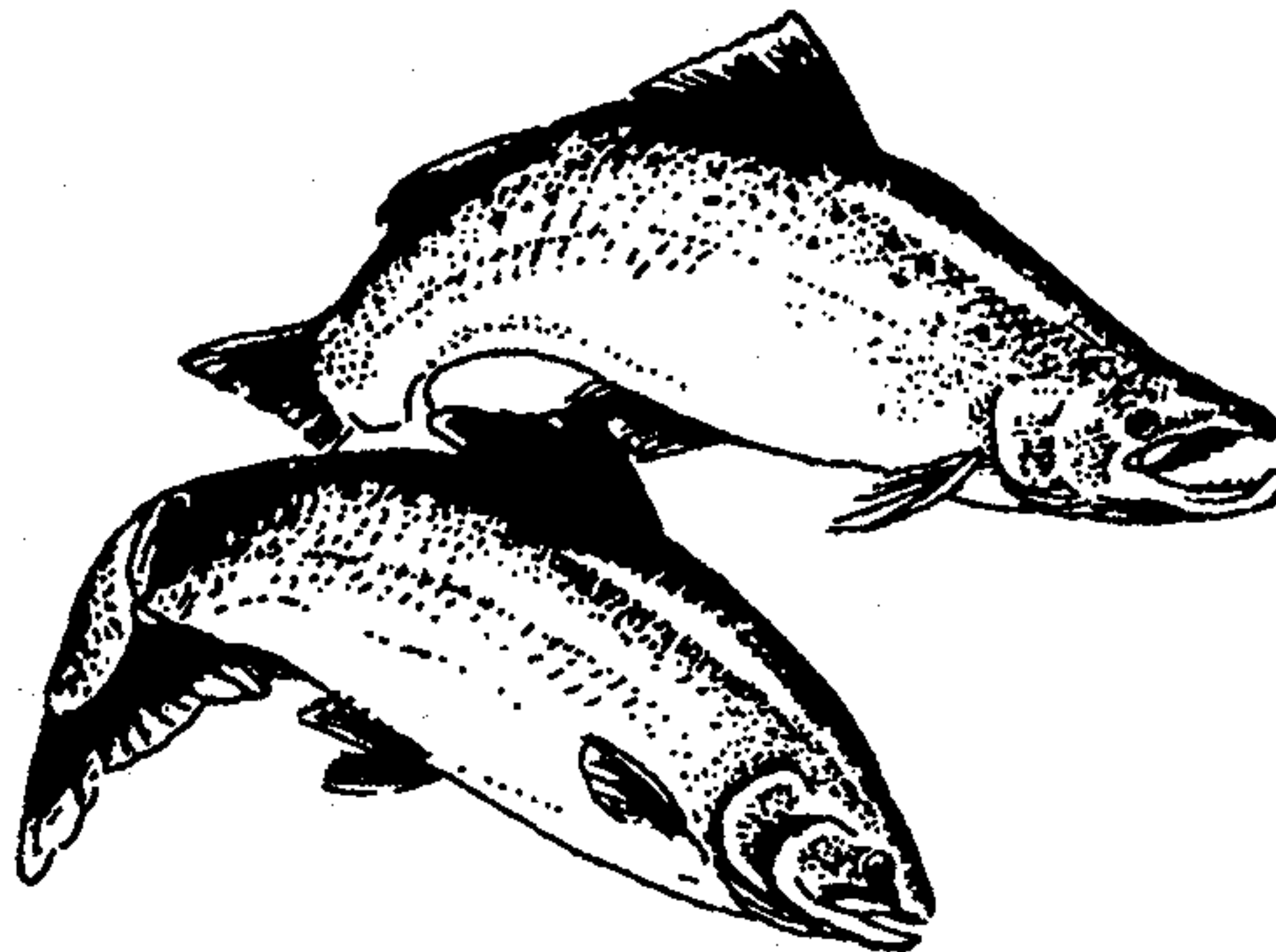
The Hiouchi community is about 10 miles east of Crescent City at the northern end of Redwood National and State Parks next to Jedediah Smith Redwoods State Park. The community is in unincorporated Del Norte County on both sides of the Smith River, although most development is along U.S. Highway 199 on the north bank of the river. The main built-up area of Hiouchi is just east of the NPS Hiouchi information center along Highway 199 and consists of two RV parks including one RV resort, a gas station/market, a gift shop, a redwood burl seller, a river rafting operation, a motel, and a cafe. The Smith River Fire District has a two-bay fire station at this location.

The Klamath Community

Near the coast, the Klamath community is outside the RNSP boundaries about midway through the parks near the mouth of the Klamath River, about 20 miles south of Crescent City along U.S. Highway 101. In unincorporated Del

Norte County, the Klamath area has a strong American Indian presence and much of the Klamath community is within Yurok Reservation boundaries.

Most of the built-up area of the Klamath community is on the north side of the Klamath River. Near the river on the north side of the bridge off of U.S. Highway 101 there is a large RV park and campground, cafe, gas station, outboard motor service facility, and a well-known tourist attraction. Within the nearby small residential/commercial area there is a church, shopping center (closed for business), cafe, motel, automatic laundry services, U.S. post office, an RV park, a Bureau of Indian Affairs (Law Enforcement Services) office, Klamath Senior Center, and 20+ houses. About 1 mile farther north on U.S. Highway 101 there is a smoke house, jet boat tour facilities, a redwood burl seller, a trading post, and two RV parks. Continuing further north, there are two RV parks, two motels, a gas station, a market/hardware store, a cafe, and a church. A Yurok tribal office is also located in this area. Finally, a major privately owned visitor attraction and motel restaurant (Trees of Mystery) is further north on U.S. Highway 101. Fire protection and community services are provided to the Klamath community by the Klamath Fire Protection District and Klamath Community Services District.



PUBLIC SAFETY

EARTHQUAKES AND TSUNAMIS

The northern coast of California is the most seismically active region in the continental United States. Since the 1850s, more than 60 earthquakes have caused property damage in northern California. However, during historic times, northern Humboldt County and Del Norte County have not sustained much earthquake damage (California Office of Emergency Services et al. 1996).

The Earth's surface is made up of mobile crustal plates that are up to 40 miles thick and range from hundreds to thousands of miles wide. Most earthquakes occur along plate boundaries as they slowly move and collide, are driven apart, or slide past each other. The amount of damage depends on the magnitude and distance from the earthquake, the length of the shaking, the type of soil, and the kind of structure affected.

Several important crustal plate boundaries occur near the park. The Mendocino triple junction — the convergence of the North American, Pacific, and Gorda Plates — is south of the parks, encompassing a broad zone off the Pacific Coast of Humboldt and Mendocino Counties and extending onshore perhaps as far east as Humboldt Redwoods State Park. South of the triple junction is the San Andreas Fault, the contact between the northwestward-moving Pacific Plate and the southward-moving North American Plate. The 1906 earthquake that severely damaged San Francisco and the north coast area was caused by movement along the San Andreas Fault. The average recurrence interval between earthquakes on the San Andreas Fault is several hundred years.

In northern California, much of the seismic activity is centered on the Cascadia Subduction Zone, which begins north of the triple junction near Cape Mendocino, California, and extends 750 miles northward to Vancouver Island, Canada. This zone delineates where the Juan de Fuca and Gorda Plates are slowly descending under the North American Plate. As the plates descend (are subducted), they have at times

become locked, which can cause large, severely damaging, megathrust earthquakes (magnitude 8.5 to 9 on the moment magnitude scale). These events are recorded in sediment, tree rings, and oral histories of American Indians (California Office of Emergency Services et al. 1996).

Research shows that the last great megathrust earthquake along the Cascadia Subduction Zone occurred on January 26, 1700, and that the average recurrence interval is on the order of 300 to 500 years (Satake et al. 1996). Evidence of the tsunami associated with this earthquake has been found 59 feet above mean sea level east of the Redwood Information Center in Redwood National Park (Gary Carver, Humboldt State University, pers. comm. 3/5/97). The most recent earthquake that originated along the Cascadia Subduction Zone was the Petrolia earthquake (magnitude 6.9-7.1) which occurred in April 1992 and produced some of the strongest ground shaking ever recorded in the region. Recent studies indicate that the probability of a large damaging earthquake with a magnitude of 8 or above occurring on the Cascadia Subduction Zone is 35% between 1995 and 2045 (Waethrich 1994).

Many earthquakes in the north coast area originate onshore and have a recurrence interval of about 20 years. Nine major thrust faults (sloped contact between rocks where the overlying rocks are pushed up and over the underlying rocks) along the Humboldt County coastline could cause a large-scale earthquake in the future. The 1994 Northridge, California, earthquake occurred along an onshore thrust fault similar to these.

Earthquakes can also occur offshore along the Mendocino Fault that separates the Gorda and Pacific Plates, and along faults within the Gorda Plate. They may occur every several years and have magnitudes of up to 7.5. The November 1980 Trinidad earthquake (magnitude 7.1), September 1994 Petrolia earthquake (magnitude 6.9), and the December 1994 Eureka earthquake (magnitude 5.4) all occurred along offshore

faults (California Office of Emergency Services et al. 1996).

Many areas in the parks are underlain by unconsolidated materials that are susceptible to liquefaction during an earthquake. Usually, liquefaction occurs in areas where there is a high water table, beach and dune sands, artificial fills, natural deposits of bay mud, lake deposits, and/or active Holocene age stream channels. The effects of liquefaction decrease towards the north, and in Crescent City, the area is underlain by Pleistocene age consolidated deposits that are not prone to liquefaction. Within the park, Highway 101 from Freshwater Lagoon northward to False Klamath Cove, various electrical utilities, buildings and other structures (i.e. the Klamath River bridge) are sited on deposits that are particularly prone to liquefaction during an earthquake.

Tsunamis, or tidal waves occur when the sea floor is deformed by an earthquake. In the open ocean, tsunamis can travel as fast as 600 miles per hour. Depending upon the location of the epicenter of the earthquake, a series of waves up to tens of feet high can arrive on the coastline within minutes or hours of the earthquake. Wave activity may last for hours and can cause loss of lives and significant property damage. The California Department of Conservation, Division of Mines and Geology, and others have modeled and mapped the tsunami run-up (see glossary) zone for the Eureka/Humboldt Bay and Crescent City areas (Toppozada et al. 1995). An average tsunami run-up height (wave height or highest elevation that should be affected by a tsunami) for the northern California coastline between Eureka and Crescent City has been estimated to be approximately 33 feet (Gary Carver, Humboldt State University, pers. comm. 3/5/97).

REDWOOD INFORMATION CENTER

During 1982 an environmental assessment was written to assess the impacts of constructing an information center in Redwood National Park. In February 1983, a "Finding of No Significant

Impact" (FONSI) and floodplain Statement of Findings" (SOF) were approved for constructing the center at a site along the coastline west of the town of Orick. The "Finding of No Significant Impact" stated that the proposed facility would be situated above the 100-year floodplain and 500-year tsunami run-up height. Construction of the center began in 1983 and was completed in 1984. The decision to construct the Redwood Information Center on the former Cal-Pac Mill west of Orick and not at an alternate site at the south end of Elk Prairie was based on the concern for potential adverse impacts to the elk herd in the prairie.

The Redwood Information Center was approved for construction based on scientific knowledge current at that time. Since the early 1980s there have been considerable advances in the understanding of the earthquake potential in the region. It was previously believed that earthquakes along the north coast area would originate along strike-slip faults. Scientists now know more about the significant threat of a large, "megathrust" earthquake originating along the Cascadia Subduction Zone, a 750-mile-long fault zone that is 6 to 12 miles beneath the parks. This major fault zone has the potential to rupture along its entire length with a magnitude 9 earthquake.

The presence of the major subduction fault was discussed in a recent state publication (California Department of Conservation 1995). This publication described a minimum, computer-simulated planning scenario for earthquakes and tsunamis and liquefaction susceptibility maps for Humboldt and Del Norte Counties. Even in the 1995 scenario, which was based on only a small-segment rupture, the Redwood Information Center site is within the expected tsunami run-up zone and in a zone of high liquefaction susceptibility.

Subsequent study has shown that the potential rupture length on the fault and consequent tsunami threat is even greater than it was estimated in 1995. Geoscientists from Humboldt State University have found evidence from studies of marsh sediments east of the center and heard oral histories from American Indians and

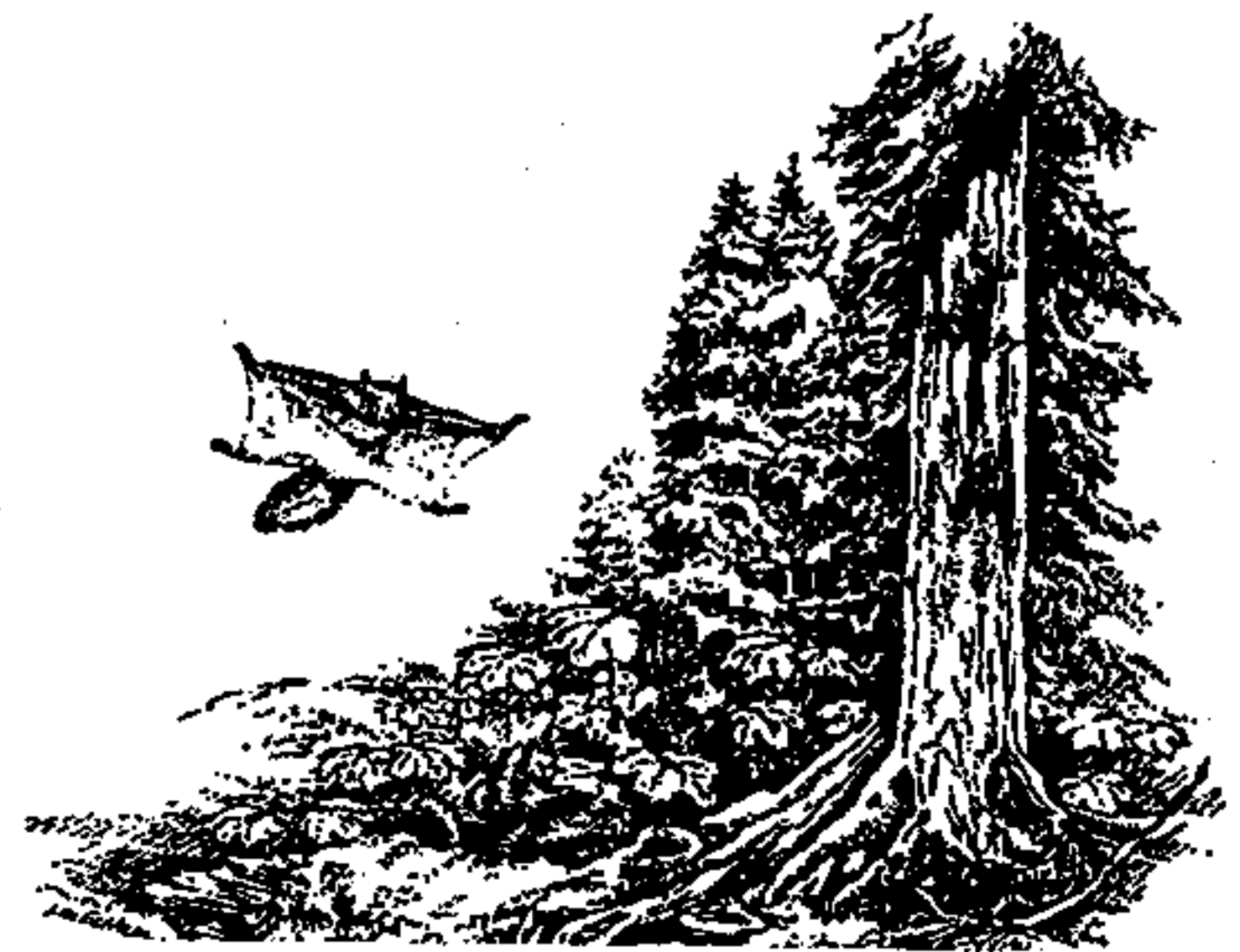
AFFECTED ENVIRONMENT

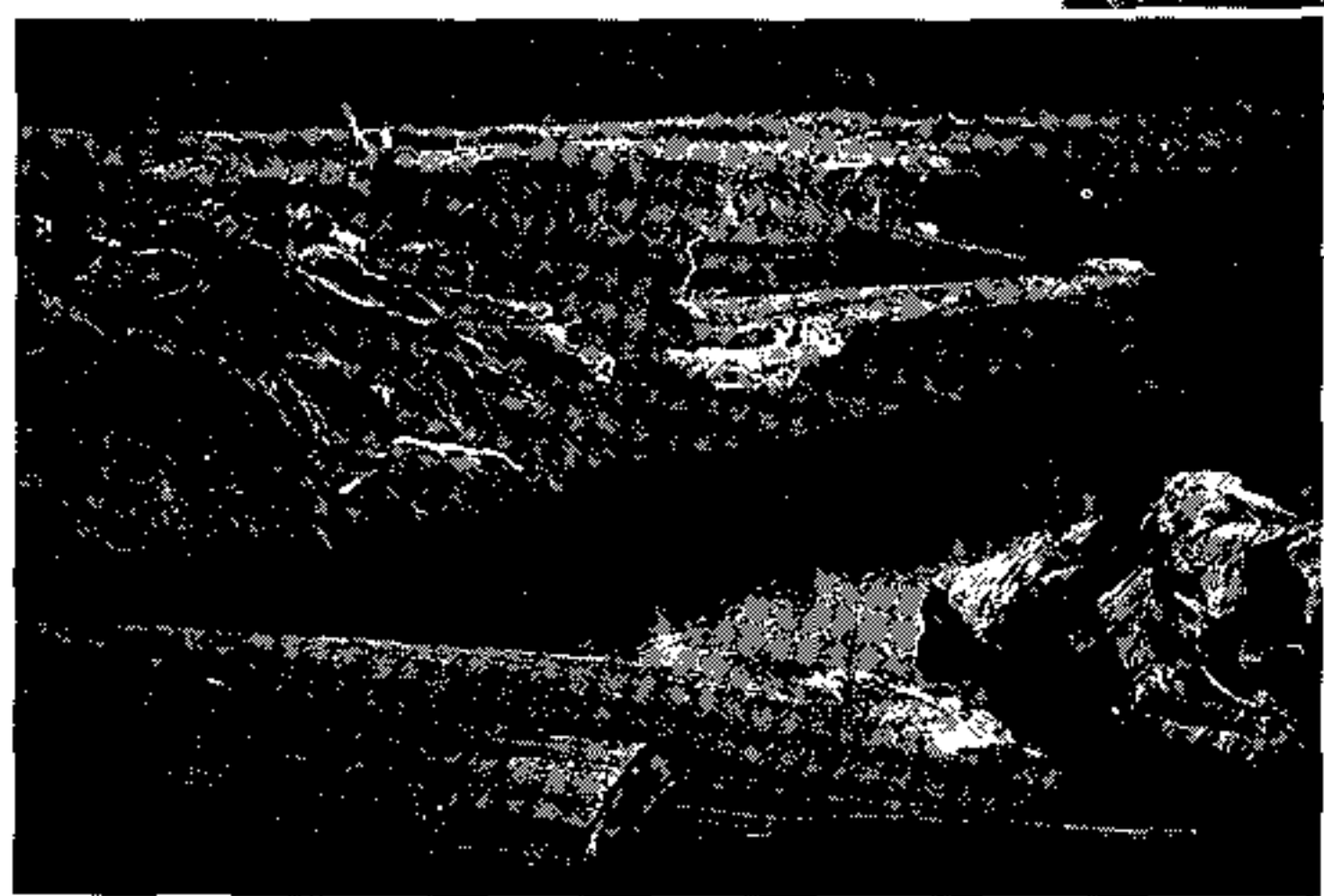
residents in Orick that tsunami run-up heights have reached 50 to 75 feet in the past (G. Carver, Humboldt State University, pers. comm. 1/98). In other words, a 50- to 75-foot tsunami would overwash the center and cause considerable damage or even destroy it. When an earthquake occurs along this zone, previous estimates for the 500-year tsunami run-up height of 16.9 feet would be a gross underestimate, and the center could be overwhelmed by 50- to 75-foot high tsunami waves. The tsunami could arrive within minutes, possibly before the ground shaking stopped, posing a considerable threat to life and property.

In addition to tsunami threats, Redwood Information Center could be damaged by Redwood Creek. Geomorphic processes at the mouth of Redwood Creek were poorly understood when the center was being planned. During November 1994, Redwood Creek migrated 700 feet towards the south and came within 115 feet of buried

utilities and within 215 feet of the facility. Lateral migration and erosion toward the center proceeded at an average rate of 20 feet per day over a 10-day period. As a result, the U.S. Army Corps of Engineers gave verbal approval to breach the natural sandbar so that the river could discharge into the ocean north of the center and temporarily protect the center from damage. Since then, the National Park Service has applied for and received a U.S. Army Corps of Engineers section 404 permit that allows RNSP staff to manipulate the channel to protect the Redwood Information Center. Under high streamflow conditions the river could again migrate towards the south and threaten the facility.

The threat of lateral migration by Redwood Creek, coastal erosion, large storms, and the regional seismic risk jeopardize the long-term existence of the Redwood Information Center and may pose a hazard to public safety.





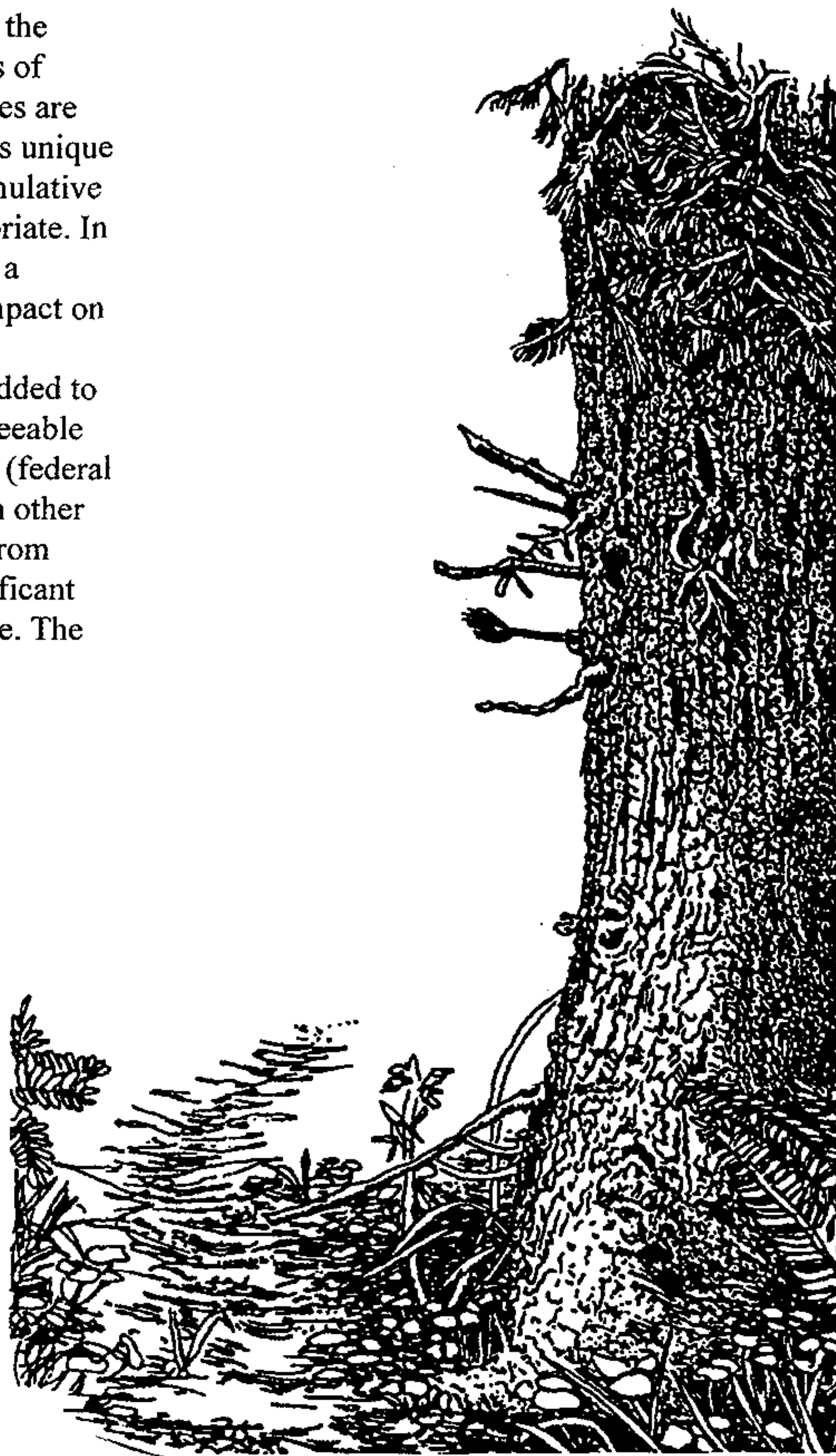
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The "Environmental Consequences" chapter describes the impacts of implementing each alternative. The chapter is organized by alternative, with impact topics as subtopics.

Before the presentation of impacts, there is a summary of regulations and policies that guide and limit management actions, which are listed by the impact topics. This is followed by the methods and assumptions used to assess the impacts on each topic. Then, the impacts of actions that are common to all alternatives are given, followed by the impacts of actions unique to each alternative. Conclusions and cumulative impacts are also discussed where appropriate. In 40 *Code of Federal Regulations* 1508.7, a "cumulative impact" is defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The

impacts of earthquakes, tsunamis, and floods (see "Impacts on Floodplains and Estuaries") are also discussed. These events may impact the public's health and safety where visitor use has been enabled or encouraged by facilities called for in the alternatives in areas where these events may occur.



REGULATIONS, ASSUMPTIONS, AND METHODS FOR EVALUATING IMPACTS

NATURAL RESOURCES

Air Quality

Summary of Regulations and Policies

The Clean Air Act of 1963, as amended (42 U.S.C. 7401 et seq.), requires federal agencies to comply with all federal, state, and local air pollution requirements and to protect park air-quality-related values from degradation. The Clean Air Act also assigns the federal land manager (park superintendent) the responsibility to protect the park's air-quality-related values (including visibility, plants, animals, soils, water quality, cultural and historic resources and objects, and visitor health) from adverse air pollution impacts.

The Clean Air Act and the California Clean Air Act mandate the establishment of national and state ambient air quality standards. These acts establish maximum allowable increments beyond baseline concentrations of air pollutants. The parks are required to comply with the California *State Implementation Plan* for achieving national ambient air quality standards for criteria pollutants and deterioration goals for protecting air quality and visibility, and to comply with the local air pollution control districts' rules and regulations. In addition, 1988 NPS *Management Policies* address the need to analyze air quality during park planning. NPS *Management Policies* state that "The National Park Service will seek to perpetuate the best possible air quality in the park because of its critical importance to visitor enjoyment, human health, scenic vistas, and the preservation of natural systems and cultural resources" (NPS 1988, 4:17).

Assumptions and Methods for Assessing Impacts

Clean air is an essential component of visitor enjoyment and environmental quality at Redwood National and State Parks, and no

management activities would be proposed or undertaken that would cause long-term air quality degradation. Natural climatic conditions and lack of major sources of air pollutants in the area would continue to contribute to the excellent air quality in the parks.

Environmental impacts were assessed by discussing proposed management activities and obtaining best professional judgement from RNSP staff and the NPS Air Resources Division staff.

Soils

Assumptions and Methods for Assessing Impacts

RNSP facilities would only be constructed in areas that were not prone to mass wasting and severe erosion. Sites considered for construction projects would be evaluated for their erosion potential before the design phase of the project. Where facilities are currently in a geologically unstable area (such as at Requa), they would be stabilized to the greatest extent feasible. Mitigation measures (such as silt fences, trenches, and bales of hay) would be used during construction activities to protect downstream aquatic resources, wildlife, vegetation, and water quality.

Since 1978 the National Park Service has had an ongoing research and watershed restoration program in Redwood Creek basin. Stream crossings along logging haul roads were comprehensively inventoried using photos, maps, and field reconnaissance, and sites were evaluated for their erosion potential based on hillslope position, geology, soils, and drainage area upslope from the site. Watershed restoration activities in Redwood Creek basin are based on the following priorities (listed in order of importance):

- Protection of RNSP resources that have been identified in Redwood National and State Parks' enabling legislations and other applicable laws and policies.
- Protection of federal and state-listed rare, threatened, and endangered species.
- Protection of the most scarce and pristine ecosystems and habitats such as old-growth redwood forests and prairies/oak woodlands.
- Protection of cultural and scenic resources that are threatened by road-induced erosion.
- Restoration of areas where treatment is most effective at reducing further degradation of RNSP resources.

About 155 miles of logging roads in Redwood Creek basin would be treated to some extent under all of the alternatives. The extent of restoration of these roads varies among the alternatives.

The ongoing failure and erosion of abandoned roads, road benches, and stream crossings, and the probability of a large storm causing further devastating, irreversible damage to natural and cultural resources in Redwood Creek basin support the urgent need for an aggressive, continually funded watershed restoration program within and upstream of the national park. There is a high probability of a 25-year storm occurring in the next two decades, because the last 25-year-storm event was in 1975. If such a large storm occurs before all the abandoned logging roads are treated, park resources could be significantly damaged.

There are more than four times as many miles of road on private lands upstream from the national park in the Redwood Creek basin (1,110 miles) than there are in the national park (225 miles; see Roads in the Redwood Creek Basin map). The large erosion potential residing in areas upstream of the national park and the threat to downstream resources, particularly along the main channel of Redwood Creek, necessitate cooperative efforts and relations with private landowners upstream of the national park. Cooperative activities between RNSP staff and private landowners would occur with all alternatives. Cooperative

activities could include review of proposed timber harvest activities and regulations, cooperative erosion prevention and road decommissioning, data development for basinwide coordinated resource management planning, and continued monitoring and scientific studies of the biological and physical parameters necessary for watershed health, stability, and protection of park resources.

During watershed restoration activities in Redwood Creek basin, approximately 10,000 cubic yards of soil would be excavated in a typical 50-hour workweek. This figure assumes two pieces of excavating equipment with moderately skilled operators, minimal end-hauling of the soil, and only one week of shutdown due to rain. Restoration work would normally last about two months per year, but varies due to weather and timing restrictions in areas that have marbled murrelets, northern spotted owls, and/or coho salmon habitat.

Past studies indicate that stream diversions may account for more than half of the road-related erosion in Redwood Creek basin. However, in the January 1997 storms, the predominant mechanism for damage to resources was fill failures associated with sidecast road fills. Additionally, the majority of these fills were not identified as potential erosion sites in the RNSP road inventory because there was no previous indication of such potentially serious consequences.

Funding for the watershed restoration program in the national park was increased in 1997 to repair damage from the January 1997 storms, and will be reduced to previous levels (fiscal year 1996 appropriations) when the storm damage has been repaired. Completion dates for the alternatives are based on these prior funding levels. Watershed restoration inside the park could be accelerated and completed more quickly if funds were appropriated at higher levels than in previous years or threatened and endangered species restrictions allowed earlier start dates to conduct restoration work.

Funding for erosion prevention or road decommissioning on private lands upstream of the national park is less certain. The national park is authorized to use NPS funds for such work on private lands in the Redwood Creek basin, but most projects completed to date have been funded by limited outside funding sources. Current funding levels for private land restoration are inadequate to address threats to RNSP resources. Restoration priorities have remained inside the park, partly due to the poor relations the National Park Service had with private landowners following the 1978 park expansion. Today, relationships have greatly improved with private landowners, official agreements have been signed by the primary stakeholders, and there is an increasing awareness of the importance to control or prevent erosion from roads. RNSP staff continues to seek outside funding and landowner cost-share agreements to fund restoration on private lands upstream from the park. Major and more rapid progress in reducing threats to RNSP resources from upstream land management activities are not possible without significant increases in available funds.

This impact assessment focuses on the erosional effects on RNSP resources from the proposed construction, removal, relocation, or improvement of park roads, trails, parking areas, buildings, and other facilities, and also from the parks' disturbed lands restoration program in Redwood Creek basin. Potential impacts on soils were assessed by reviewing research conducted by the National Park Service and the U.S. Geological Survey (studies done by the USGS Biological Resources Division) for the NPS watershed restoration program and Redwood Creek's estuary management plan (D. Anderson, RNSP fishery biologies, pers. comm., 1997). Results of the studies were reviewed to determine the potential impacts on soils from these activities.

Water Quality

Summary of Regulations and Policies

The 1972 Water Pollution Control Act, as amended by the Clean Water Act of 1977, established a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters; to enhance the quality of water resources; and to prevent, control, and abate water pollution. The act requires states to adopt water quality standards for its navigable waters, authorizes the preparation of areawide wastewater management plans (section 208), provides for the planning related to the control of nonpoint source pollution, and mandates state adoption of numerical standards for priority pollutant toxic chemicals. Section 101 of the 1977 Clean Water Act requires federal agencies to cooperate with state and local agencies to eliminate pollution in waters of the United States.

Water quality protection pursuant to the Clean Water Act has been delegated from the Environmental Protection Agency to the California Water Resources Control Board. The state Water Resources Control Board and nine regional water quality control boards were established by the California Porter Cologne Water Quality Control Act of 1969. The act authorizes the state board to adopt, review, and revise state water policy and planning processes by the regional water boards. Local implementation of the water quality plan for the north coast region is the responsibility of the North Coast Regional Water Quality Control Board in Santa Rosa, California. Clean Water Act section 401 permits are required from the North Coast Regional Water Quality Control Board to certify that projects meet state and federal water quality standards.

Water quality is regularly monitored by the U.S. Geological Survey, California Department of Water Resources, and California Department of Fish and Game, and it is primarily regulated for

activities affecting water quality through the issuance of waste discharge (National Pollution Discharge Elimination System) permits and other enforceable orders (North Coast Regional Water Quality Control Board 1997). For more information on water quality plans, criteria, and standards, see the discussion of water quality in the "Affected Environment" section of this plan.

Both the National Park Service and the California Department of Parks and Recreation must obtain U.S. Army Corps section 404 permits under the Clean Water Act when applicable. A separate permit from the State Regional Water Quality Control Board under section 401 of the Clean Water Act (state 401 certification) must accompany a section 404 permit to ensure that water quality is maintained. The state regulates the alteration of a lake or stream channel under sections 1601–1606 of the *California Fish and Game Code*. The National Park Service and California Department of Parks and Recreation are subject to different permit requirements under California Department of Fish and Game (CDFG) regulations. The California Department of Parks and Recreation must obtain CDFG section 1603 streambed alteration agreements for instream work in state parks. However, section 1603 agreements are not required on federal lands outside of the state parks. Acquiring a 1603 agreement does not eliminate the need for a section 404 permit and section 401 certification.

The 1988 NPS *Management Policies* provide direction for the preservation, use, and quality of water originating, flowing through, or adjacent to park boundaries. The National Park Service seeks to restore, maintain, and enhance the quality of all surface and groundwater within the park consistent with the 1972 Federal Water Pollution Control Act, as amended, and all other applicable federal, state, and local laws and regulations.

The Safe Drinking Water Act, as amended, requires the Environmental Protection Agency to establish primary and secondary drinking water standards. It also requires federal agency compli-

ance with federal, state, and local drinking water requirements. The California Department of Water Resources has the primary responsibility for monitoring surface and groundwater quality for consumptive uses.

Assumptions and Methods for Assessing Impacts

Ongoing water quality monitoring programs by RNSP staff, the North Coast Region Water Quality Control Board, the California Department of Water Resources, the U.S. Geological Survey, and the California Department of Fish and Game would continue. If specific water quality concerns arise, they would be dealt with by altering RNSP programs and activities. The primary water quality concern in the parks is nonpoint source pollution from increased sediment loads in the streams from past and present nonpark logging activities; this concern is being dealt with through watershed restoration programs throughout Redwood Creek basin. It is expected that through time, water quality in the parks will continue to improve.

Potential impacts on water quality were assessed by reviewing the *Water Quality Control Plan for the North Coast Region, A Compilation of Water Quality Goals* (May 1996), and water monitoring data collected by the California Department of Water Resources and RNSP staff. Staff at Redwood National and State Parks, the California Department of Water Resources, the North Coast Region Water Quality Control Board, and the California Department of Health Services were also queried about potential impacts on water quality.

Floodplains and Coastal Zone

Summary of Regulations and Policies

Executive Order 11988, "Floodplain Management," and the 1993 NPS *Floodplain Management Guideline* requires the National Park Service to evaluate the potential effects of any actions it may take in a floodplain to (1) ensure

that its planning programs consider flood hazards and floodplain management; (2) minimize the impacts of floods on human safety, health, and welfare; and (3) restore and preserve the beneficial values served by floodplains. If the National Park Service proposes an action that would be undertaken in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplain. The floodplains subject to regulation by the executive order include the 100-year, 500-year, and extreme floodplains.

The federal Coastal Zone Management Act (16 U.S.C. 1451 et seq.), first passed in 1972 and reauthorized as the Coastal Zone Management Act of 1990, specifies that each federal agency conducting or supporting activities directly affecting the coastal zone shall undertake or support those activities in a manner that is, to the maximum extent practicable, consistent with the approved state management program. The state of California developed the California Coastal Management Program (CCMP) pursuant to the requirements of the Coastal Zone Management Act. The coastline within the parks is within the California coastal zone delineated in the management program. The California Coastal Commission is charged with regulating development in the coastal zone.

Lands whose uses are subject solely to the discretion of the federal government are excluded from the coastal zone. If activities on these excluded lands affect the coastal zone, they must be reviewed for consistency with the California Coastal Management Program. The final proposed action for the management of federal lands within the coastal zone would be submitted to the California Coastal Commission for a consistency determination.

Federal consistency determination is a process that enables the state to review and influence federally conducted, approved, or funded activities that affect the uses and resources of the coastal zone for consistency with the policies and regulations of the state coastal plan. State lands within the coastal zone are subject to direct

review by the Coastal Commission rather than requiring consistency determinations.

The California Coastal Act of 1976, as amended, is the key policy component of the California Coastal Management Program (CCMP). The National Park Service and California Department of Parks and Recreation must ensure consistency of actions or development with respect to CCMP policies and regulations regarding public access, water and marine resource management, commercial fishing, and recreational boating, and the management of environmentally sensitive habitat, agricultural activities, scenic and visual resources, and potential hazards.

The construction of trails, roads, parking lots, picnic areas, and structures in coastal areas are subject to review or consistency determination. Coastal areas of Prairie Creek and Del Norte Coast Redwoods State Parks are subject to review by the Coastal Commission. Federal actions within the coastal zone at Freshwater Lagoon Spit, the Redwood Creek estuary, portions of the Coastal Trail, national park lands at the mouth of the Klamath River, Lagoon Creek picnic area, and Enderts and Crescent Beaches would be subject to a federal consistency determination by the California Coastal Commission.

Assumptions and Methods for Assessing Impacts

The focus of this impact assessment is on the floodplain in the lower Redwood Creek embayment area. This includes the area west of the town of Orick to the Pacific Ocean and encompasses the lower 0.6 mile of the federal flood control levees along Redwood Creek. Over the long term, RNSP management strategies are to reestablish natural hydrologic and biologic processes to the extent feasible in the lower Redwood Creek embayment area. Management actions proposed in this joint plan would meet these strategies to varying degrees with the four alternatives.

To restore hydrologic and biological processes in the Redwood Creek embayment area, it may be necessary to acquire interests in certain parcels of land. Property within this area would be acquired for these purposes on a willing seller basis and could include purchase of fee-simple interest or flood or conservation easements. Where land is not acquired for restoration purposes within the restored 100-year floodplain, there would be mitigation for damage that could occur to structures during a large flood. The extent of restoration of the estuary would depend on the level of cooperation of the landowners and the National Park Service.

Only a small portion of the lands near the mouth of the Klamath River are federal lands administered by the National Park Service. Because the only actions proposed on these lands are at the Brush Dance site, no other areas in the Klamath River basin will be discussed in the "Environmental Consequences" section of this document.

Flooding impacts could also occur in other developed areas (campgrounds, administrative and other facilities) in the park, particularly along the Smith River and Prairie Creek. However, because the 100-year floodplain has not been consistently mapped throughout the parks, it is not possible to quantify impacts on the parklands. To date, mapping of the 100-year floodplain has been done along the Smith River near Hiouchi and along Prairie Creek from the fish hatchery to Orick.

Impacts on the Redwood Creek floodplain and estuary, including flooding, were assessed by reviewing the NPS *Floodplain Statement of Findings for the Redwood Information Center* (1982a), and the U.S. Army Corps of Engineers' "Redwood Creek Estuary Proposed Restoration Plans Hydrologic and Hydraulic Analysis" (USACOE 1994), and thorough discussions with RNSP geologists and fisheries biologists. Potential impacts are based on best professional judgement and have been developed through discussions with the California Department of Water Resources, National Park Service, California Department of Parks and Recreation,

and USGS personnel. Flooding impacts were evaluated by reviewing Federal Emergency Management Agency floodplain maps for the parks and hydrologic data prepared by the U.S. Geological Survey and the Federal Emergency Management Agency.

Wetlands

Summary of Regulations and Policies

Wetland protection and management programs in the National Park Service are based primarily on the requirements of the National Environmental Policy Act, the Clean Water Act, their respective implementing regulations, and Executive Order 11990, "Protection of Wetlands." In addition, NPS management of wetlands must be consistent with requirements of Executive Order 11988, "Floodplain Management" and the 1993 NPS *Floodplain Management Guidelines*, the Coastal Zone Management Act of 1972, as amended, section 10 of the Rivers and Harbors Appropriation Act, the Fish and Wildlife Coordination Act, and the state and federal Wild and Scenic Rivers Acts.

Some activities in wetlands are regulated by the U.S. Army Corps of Engineers under section 404b of the Clean Water Act. Section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act require U.S. Army Corps of Engineers permits to regulate discharge of dredged and fill material and incidental discharges associated with excavation activities within waters and wetlands of the United States. The corps issues permits under section 404 of the Clean Water Act for activities that discharge dredged or fill material into waters of the United States, including wetlands. Regulated activities range from placing fill for building pads to discharge assumed to occur as a result of mechanized land clearing or excavation in wetlands.

The Corps of Engineers' section 404b guidelines specify a three-step process for meeting a national policy of no net loss of wetlands: (1) avoidance — finding another alternative that

does not involve wetlands damage, (2) minimization — minimizing the wetlands impact of the project design, and then, only after the first two conditions have been met, (3) mitigation — compensating for the unavoidable wetlands damage. The National Park Service strives to achieve a broader goal of netgain of wetland acreage and functions servicewide both by avoiding wetland impacts and through restoring wetlands that have been degraded or lost due to human activities.

In 1993 the governor of California released the California Wetlands Conservation Policy (Executive Order W-59-93). The order declared that among the objectives of California wetland policy are to ensure no overall net loss and a long-term net gain in the quantity, quality, and permanence of wetland acreage and values in California in a manner that fosters creativity, stewardship, and respect for private property; and to encourage partnerships to make restoration, landowner incentive programs, and cooperative planning efforts the primary focus of wetland conservation.

Wetlands within the coastal zone are specifically included as an environmentally sensitive habitat area. Section 30231 of the Coastal Act defines a wetland as:

lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens

Diking, filling, or dredging in the Redwood Creek estuary or the Lagoon Creek impoundment would be subject to section 30233 of the Coastal Act, which regulates the development or alteration of coastal wetlands. This section stipulates criteria under which development is permitted (i.e., the development must be the least environmentally damaging alternative that is possible, and appropriate mitigation measures must be completed where required).

The term “mitigation” includes a spectrum of actions that are defined by the Council on Environmental Quality as:

- Avoid the impact altogether by not taking an action or certain parts of an action.
- Minimize the impacts by limiting the degree or magnitude of the action and its implementation.
- Rectify the impact by repairing, rehabilitating, or restoring the affected area.
- Reduce or eliminate the impact over time by preservation and maintenance operations.
- Compensate for the impact by replacing or providing substitute resources or environments.

Assumptions and Methods for Assessing Impacts.

Wetlands are defined by hydrology (water flow and circulation), soils, and vegetation. Of the three factors that define a wetland, changes in wetland vegetation are the easiest to observe and interpret. It is more difficult to observe and interpret changes in the soil. Hydrology is the controlling factor. Water levels can be measured and monitored over time. Hydrologic monitoring is a rigorous method by which to predict or evaluate change, but it is costly and time consuming.

Wetlands in the parks have been identified based on the National Wetlands Inventory (NWI) maps, on site visits, and from a general understanding of the topography and vegetation of the parks. The U.S. Army Corps of Engineers defines wetlands according to the criteria found in the 1987 *Corps of Engineers Wetlands Delineation Manual*. This is a stricter definition than used by the National Park Service. The Corps' definition of wetlands requires that all three wetland criteria (soils, hydrology, and vegetation) be met for an area to be defined as a wetland. This is a stricter definition than is used by the National Park Service, so that fewer areas are defined as wetlands by the Corps than by the National Park Service. The National Park Service defines wetlands more broadly to include wetland resources and functions that are covered

under Executive Order 11990, "Protection of Wetlands," such as native plant and animal communities, habitat quality, aesthetics, historical values, and recreation.

NWI maps are assumed to closely approximate wetland types and the general location. These maps are prepared primarily from aerial photographs with limited field checking. The presence of wetlands in an area as depicted on an NWI map is considered a preliminary site assessment. Extensive field work is required to identify the hydric soils, hydrophytic vegetation, and hydrologic regime that define wetlands.

NWI maps do not show all wetlands that are actually present. NWI maps are designed so that if a site is depicted as containing a wetland, it is highly likely that a wetland is there. However, a site may also contain unmapped wetlands, especially those that are very small, or that are drier in some seasons, or that are difficult to interpret from aerial photographs, such as evergreen forested wetlands or significantly drained wetlands. High rainfall and a long growing season in the coastal region of northwestern California are more conducive to wetland formation than in most other regions of the United States, and there are likely to be more wetlands than depicted on NWI maps that cover the parks. It is reasonable to assume that all depressions, stream channels, or flat low-lying areas may meet the NPS definition of a wetland during some time of the year.

RNSP wetland areas that would require field investigations to determine wetland boundaries include estuarine and tidal areas such as the Redwood Creek and Klamath River estuaries, linear wetlands such as riparian corridors along drainage and stream channels, and partly drained wetlands such as the pastures at Davison Ranch.

If a proposed project disturbs the soil or changes the drainage patterns, soil scientists, botanists, and hydrologists would investigate soil types, plant species, and hydrology at the project site. If any of these three criteria indicate the presence of wetlands, RNSP staff would follow the steps

outlined in the NPS wetland guidelines before implementing a project. RNSP staff would also consult with the U.S. Army Corps of Engineers to determine whether any jurisdictional wetlands would be affected that would require compliance with section 404 of the Clean Water Act.

It is not possible to determine area, function, and values of affected wetlands without site-specific information on the location of projects and the extent of work required. Areas and types of wetlands affected by proposals are estimates based on experience with similar types of projects.

General impacts on wetlands are analyzed and assessed using field survey data and the best professional judgement of planners, hydrologists, soil scientists, and botanists based on comparison of similar projects in the region. RNSP staff have conducted studies of the Redwood Creek estuary since 1980 to acquire information on water quality; seasonal abundance, distribution, and use of the estuary by anadromous salmonids; salmonid food resources; and estuarine hydrology. Staff have compared aerial photographs and historical accounts of the estuary to determine original configuration and channel patterns and changes through time. Wildlife, vegetation, and soil surveys have been completed throughout the parks, although much of the survey work that was conducted before the issuance of Executive Order 11990 failed to identify wetland features, boundaries, and functions.

Watershed restoration activities that affect wetlands are subject to Executive Order 11990 and may be subject to regulation by the Army Corps of Engineers under section 404 of the Clean Water Act. The removal of artificial impoundments in upland areas, whether behind dams or resulting from road-related landslides, requires consultation with the Corps of Engineers and may require a permit and mitigation.

Small areas of persistent wetness have developed unnaturally in some upland areas of the parks because undersized culverts and inboard ditches become plugged with debris or because a road

failure causes inadequate drainage. Road failure may result from collapse of "Humboldt crossings" (a road built on soil placed on top of organic material and debris from original vegetation clearing); the plugging of undersized culverts from debris that washes into the culvert from upslope or upstream; and the in-filling of ditches followed by stream capture on the road surface. Stream capture refers to a process in which the original stream changes course when its path is blocked. Newly formed streams created by road-caused stream capture develop wetland characteristics relatively quickly in the redwood ecosystem in northwestern California. Whether or not these various unnatural wet areas are jurisdictional wetlands is unclear. Determinations of permit requirements may be needed on a case-by-case basis.

The area of wetlands affected by the alteration of the Redwood Creek levees are estimates based on U.S. Army Corps of Engineers' calculations for studies of the effects on the floodplain of realignment or partial removal of the levees. The Corps calculated the extent of the floodplains for floods at the 2.5-year, 10-year, 25-year, 50-year, and 100-year frequency flood events recurrence intervals with portions of the levees removed. The 2.5-year and 10-year storm floodplains are used to estimate the area of wetland that might exist after the partial removal of levees. These estimates are considered reasonable because the NWI maps indicate that most wetlands in those portions of the estuary that would be affected by partial levee removal are seasonally or intermittently flooded. The partial removal of levees would increase the amount of land that would be seasonally and intermittently flooded.

A 300-foot buffer around intermittent and perennial streams was used to define riparian wetlands for these streams. This figure is taken from the width of riparian reserves in the *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl* (USFS, USDA, and BLM, USDI 1994). Potential impacts on intermittent and perennial stream wetlands for streams

inhabited by fish from the management of second-growth forests were assessed using geographic information system (GIS) to calculate a 300-foot-wide buffer around these streams and then determining how many acres of second-growth forest fell within the buffer.

Threatened and Endangered Species

Summary of Regulations and Policies

It is NPS policy to identify and promote the conservation of all federally listed threatened, endangered, and candidate species within RNSP boundaries and their critical habitat. Federal and state-listed threatened, endangered, rare, sensitive, and candidate species that are native to the parks have been identified and considered during planning, in accordance with NPS policy.

Federally listed or proposed threatened and endangered species are protected under the Endangered Species Act of 1973 as amended. The U.S. Fish and Wildlife Service (USFWS) in the Department of the Interior is responsible for identification and protection of threatened and endangered species of terrestrial plants and animals. The National Marine Fisheries Service (NMFS) and National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce are responsible for identification and protection of marine animals and anadromous fishes under the Endangered Species Act.

The Endangered Species Act specifically charges the secretaries of the interior and commerce with the responsibility to identify, protect, manage, and recover species of plants and animals in danger of extinction.

State-listed rare, threatened, and endangered species are protected under the Native Plant Protection Act of 1977 and the California Endangered Species Act of 1984. On January 1, 1985, all species classified by the state as "rare" were reclassified as "threatened," as stipulated by the California Endangered Species Act.

The National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (CDFG) are expected to develop regulations protecting native, naturally reproducing populations of coho salmon. In March 1998 the California Department of Fish and Game issued emergency regulations to protect steelhead in coastal rivers included in areas designated by the National Marine Fisheries Service as the Klamath Mountain Province and the Northern California populations. Regulations for the Smith River are less restrictive than those for other streams in the area. Fishing regulations are based on estimates of numbers of reproducing fish in a population.

Aspects of recreational fishing that may be regulated include limits on number of fish that can be taken or possessed; methods of taking, such as barbless hooks or artificial lures; the length of fishing season; the closure of streams or portions of a stream; and restrictions on fishing during low flow periods.

Candidate Species. The term "candidate species" has different meanings under federal and state endangered species legislation. Candidate species for state listing are those that the California Fish and Game Commission has formally identified as being under review by the Department of Fish and Game for addition to the state list.

In February 1996 the U.S. Fish and Wildlife Service issued a notice in the *Federal Register* (50 CFR 17.11) changing the way in which proposed and candidate species for listing are classified. Proposed species are those species for which the U.S. Fish and Wildlife Service has published a proposed regulation under which the species would be listed as endangered or threatened. Candidate species are those species for which the U.S. Fish and Wildlife Service has enough information on biological vulnerability and threats to a species to support a proposal to list the species, but has not yet developed the proposed regulation. Before February 1996 species now described as candidate species were known as category 1 candidates. Other cate-

gories of candidate species were discarded to simplify the listing process.

Neither federal nor state candidate species are subject to the provisions of the federal Endangered Species Act or the California Endangered Species Act, respectively. Identifying candidate species in the parks assists environmental planning and resource protection efforts by providing advance notice that a species is biologically vulnerable and could potentially be listed. Early notice can prompt resource managers to begin conservation measures and work to alleviate threats that, if unchecked, might lead to listing of a species.

Critical Habitat. Critical habitat is defined in the Endangered Species Act as

the specific areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed . . . upon a determination . . . that such areas are essential for the conservation of the species.

The California Endangered Species Act (CESA) contains a similar concept to critical habitat called essential habitat. The state does not necessarily designate essential habitat in terms of mapped and described areas, as does the U.S. Fish and Wildlife Service for critical habitat. State laws and regulations do not specifically defer to or recognize federal critical habitat. California Department of Fish and Game biologists, in their normal CESA and California Environmental Quality Act (CEQA) review of proposed activities, may be aware of critical habitat and consider it in lieu of essential habitat. However, there is no requirement to do so and no prescribed manner for treating critical habitat.

Section 7 of the Endangered Species Act discusses actions carried out, authorized, or funded by a federal agency that may affect designated critical habitat. Designated critical habitat for marbled murrelets in the state parks is subject to federal section 7 consultations if a federal action is involved. Aside from this added consideration under section 7, the federal Endangered Species Act does not provide any extra protection to designated critical habitat. It is the policy of both the National Park Service and the California Department of Parks and Recreation to avoid the destruction or adverse modification of critical habitat and to protect designated critical habitat to the fullest extent possible.

The destruction or adverse modification of critical habitat is defined as

a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

Assumptions and Methods for Assessing Impacts

Impact is synonymous with effect in this document. Under the National Environmental Policy Act, the term "effects" includes direct and indirect effects, which may be either beneficial or detrimental (40 CFR 1508.8). Under the California Environmental Quality Act, the phrase "significant effect on the environment" is defined as a "substantial, or potentially substantial *adverse* change in the environment" (PRC 21068). Because of this difference between the terms, impacts are characterized as beneficial or adverse to the extent possible. If the term impact is used without a modifier, it should be assumed to be an adverse impact.

In this impact analysis, the following criteria are used to estimate the significance of an action with respect to its effect on listed threatened and endangered species. These criteria of significance apply primarily to adverse effects and are based on the terminology used by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service in their consultations under section 7 of the Endangered Species Act. Before taking an action, the National Park Service prepares an evaluation of the potential effects on listed threatened and endangered species. The National Park Service requests that the U.S. Fish and Wildlife Service or the National Marine Fisheries Service review its determination of effects; this process is usually referred to as an informal consultation. If both those agencies agree with the National Park Service that a proposed action has no effect, or is unlikely to adversely affect, a listed species, then the National Park Service has completed its responsibilities under the Endangered Species Act, and it proceeds with the action. If the U.S. Fish and Wildlife Service or the National Marine Fisheries Service does not concur with the NPS assessment of no effect, or if the National Park Service determines that an action might adversely affect a listed species, the National Park Service must initiate formal consultation.

The process of formal consultation requires that the National Park Service prepare a biological assessment of its proposed action for review by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service. Following review of the biological assessment, the U.S. Fish and Wildlife Service or the National Marine Fisheries Service issues a biological opinion about the action. If either agency finds in a biological opinion that the action would jeopardize the continued existence of a listed species, the National Park Service must reconsider its action, and modify the action so that endangered species would not be placed in jeopardy. Any action that may jeopardize the continued existence of a species, or which would result in either agency issuing a jeopardy opinion based on consultation under Section 7, is defined as a significant, or major, adverse impact.

Some actions might have adverse effects on listed species but do not jeopardize the continued existence of the species. If, during formal consultation, the U.S. Fish and Wildlife Service or the National Marine Fisheries Service finds that the effects of a proposed action would not jeopardize the survival of the species, the agency usually issues a permit for incidental take of listed species in these situations under section 10 of the Endangered Species Act. Any action that might adversely affect a listed species without jeopardizing its continued existence, or for which either the U.S. Fish and Wildlife Service or the National Marine Fisheries Service is likely to issue an incidental take permit, is defined as having a moderate adverse effect.

Actions that have no effects on listed species, or that might affect a listed species but are not likely to adversely affect the species, are defined as minor.

Watershed restoration projects in Redwood National and State Parks have been curtailed since 1994 because of noise restrictions to protect northern spotted owls and marbled murrelets during their respective breeding seasons. Because of the difficulty of locating marbled murrelet nests, any forest stand that contains trees with characteristics suitable for murrelet nesting is assumed to be occupied by murrelets unless surveys prove otherwise.

It is assumed that the long-term benefit for marbled murrelets from restoring forest through watershed restoration and second-growth forest management would not be realized until redwood and Douglas-fir trees grow back to at least half of their potential height. Using a conservative estimate of 200 feet for both redwood and Douglas-fir, it is assumed that it would take about 100 years for trees to reach 100 feet in height.

Long term is defined here as 100–200 years, based on the time given in the “Recovery Plan for the Threatened Marbled Murrelet” (USFWS 1997, p. 121) as that required to develop suitable nesting habitat. The U.S. Fish and Wildlife

Service defines long term as “greater than 200 years” (USFWS 1997, p. 112) and 50–100 years as the short term (USFWS 1997, p. 116). To simplify the analysis, long term for northern spotted owls is defined to be the same, even though trees as young as 40 years of age have been known to support nesting owls. The U.S. Fish and Wildlife Service considers 40 years as the youngest age of trees that should be considered suitable nesting habitat for northern spotted owls in this portion of their range (R. Wallen, RNSP, pers. comm. 2/99).

With respect to sediment deposited in streams relative to the effects of that sediment on fish habitat, studies have shown that sediment in the upper reaches of a channel may remain 25–100 years, depending on how close to the active channel the sediment is stored, the amount and type of large woody debris in the channel, the channel gradient, and stream power. In the lower reaches of a stream such as Redwood Creek, sediment may persist for 10 to 100 years or more. Because a stream reach is a short segment of a stream, the sediment will take decades to centuries to move out of the entire stream (Hagans et al. 1986). Thus, with respect to effects of watershed restoration projects on listed fish, short term is defined as less than 10 years, and long term is defined as on the order of decades to centuries.

Acreages of endangered species habitat, including old-growth forest, second-growth forest lands, and lands with characteristics suitable for northern spotted owl and marbled murrelet nesting were calculated using computer-based geographic information system (GIS) technology. See appendix J for how sound level measurements were used to determine impacts on threatened and endangered species.

Disturbance Effects. Wildlife may be disturbed by human presence, activity, or movement with or without loud noise. Analysis of disturbance to threatened and endangered wildlife species is based on interviews with wildlife and fisheries biologists, the review of pertinent literature and documents, and an analysis of trends in and

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around the parks and within the redwood ecosystem, forest lands, and river systems in the Pacific Northwest.

Noise can have adverse effects on wildlife species. Some wildlife species are more tolerant of noise than other species. The intensity of noise is assumed to be equivalent to loudness. Repetitive and intrusive noises such as jackhammers are generally considered more disruptive than continuous or steady noises at the same decibel levels. Noise is attenuated by distance from the source and by obstructions such as topographical features, structures, vegetation, and by weather conditions such as fog or wind.

Acceptable noise levels for natural wildlife and recreational areas are 60 dBA. Construction activities typically generate noise in the range of 80-90 dBA, L_{eq} . (Bolt, Beranek, and Newman 1971) (see table 22). Watershed restoration uses equipment equivalent to that used in construction. Ground clearing results in about 84 dBA, L_{eq} , at 50 feet, where the noisiest piece of equipment is 50 feet from the receptor and other equipment is 200 feet from the receptor. Excavation produces a noise level of 89 dBA, L_{eq} , at 50 feet. To reduce the noise levels from these two operations to 60 dBA, one must be 790 and 1,400 feet, respectively, from the source. See appendix J for a general discussion of how noise

levels are calculated and for a list of generally acceptable noise levels for different types of land use.

The U.S. Fish and Wildlife Service has established 0.25 mile as the distance at which northern spotted owls or marbled murrelets may be disturbed by human activity and noise greater than ambient levels. If there is suitable owl or murrelet habitat within a 0.25 mile radius of a project that might create noise or disturbance, RNSP staff are required to initiate informal consultation under section 7 of the Endangered Species Act.

CULTURAL RESOURCES

The National Park Service is mandated to preserve and protect its cultural resources through the organic act of 1916 (U.S.C. Title 16) and such specific legislation as the Antiquities Act of 1906 (16 U.S.C. 431), the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321, 4331, 4332), and the Archeological Resources Protection Act of 1979 (16 U.S.C. 470). In addition, the management of cultural resources would be guided by the Advisory Council on Historic Preservation's implementing

TABLE 22: TYPICAL NOISE LEVELS FROM SELECTED CONSTRUCTION EQUIPMENT

Equipment	Noise Level (dBA, L_{eq}) at 50 feet	Distance to Reduce Noise to 60 dBA, L_{eq}
frontloader	79	450 feet
backhoe	85	890 feet
bulldozer	80	500 feet
tractor	80	500 feet
grader	85	890 feet
truck	91	1,800 feet
generator	78	400 feet

regulations regarding the "Protection of Historic Properties" (36 CFR 800), the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995), chapter V of the *NPS Management Policies* (1988), and the *NPS Cultural Resources Management Guideline* (NPS-28, 1996).

As part of its cultural resource management responsibilities, the National Park Service strives to inventory and evaluate all cultural resources on lands under its jurisdiction. Section 110 of the National Historic Preservation Act (1966) requires that historic properties be identified and evaluated for their eligibility for listing on the National Register of Historic Places. Section 110 also stipulates that historic properties be managed in a way that preserves and protects their values, especially nationally values. Cultural resources under NPS jurisdiction, as well as those not under NPS jurisdiction but that could be affected by actions outlined in this plan, were considered during this planning process.

Section 106 of the National Historic Preservation Act requires that federal agencies having direct or indirect jurisdiction over undertakings consider the effect of those undertakings on resources either listed on or eligible for listing on the National Register of Historic Places and afford the state historic preservation officer and the Advisory Council on Historic Preservation an opportunity to comment. The National Park Service would continue to work with the aforementioned entities to meet the requirements of section 106. As stipulated by the October 1995 programmatic agreement among the National Conference of State Historic Preservation Officers, the Advisory Council on Historic Preservation, and the National Park Service, the California state historic preservation office and the Advisory Council on Historic Preservation were invited to participate in the planning process, and each also had an opportunity to review and comment on the draft document. Appendix H details which actions described in the alternatives require further section 106

consultation and which are excluded from further review under the aforementioned programmatic agreement.

The National Park Service would consult with affiliated American Indian tribes and develop and accomplish its programs in a way that respects the beliefs, traditions, and other cultural values of the American Indian tribes who have ancestral ties to the lands encompassed by Redwood National and State Parks. The necessity for consultations with American Indians arises from the historic and current government-to-government relationship of the federal government with American Indian tribes, particularly those that are federally recognized (*Federal Register* 1995, 9250-9255), as well as from the related federal trust responsibility to conserve tribal resources. Consultations with American Indians are also required for compliance with a variety of laws and other legal entities, such as presidential executive orders, proclamations, and memoranda; federal regulations; and agency management policies and directives. Examples are the Indian Self-Determination and Education Assistance Act (1975); the American Indian Religious Freedom Act (1978 and as amended in 1994); the Native American Graves Protection and Repatriation Act (1990); National Historic Preservation Act (as amended in 1992); the Presidential Memorandum of April 29, 1994, entitled "Government-to-Government Relations with Native American Tribal Governments"; and Executive Order 13007 of May 24, 1996, entitled "Indian Sacred Sites."

Not only have RNSP staff extensively consulted with American Indians tribes over the past 16 years, but there is also a formal memorandum of understanding for government-to-government relations among the National Park Service, the California Department of Parks and Recreation and the Yurok Tribe (see appendix D). Under all alternatives presented in this joint plan, Redwood National and State Parks would

continue to work with the tribes in the following ways:

- Consulting on RNSP planning documents, resource management projects, and proposed developments.
- Cooperating on economic development projects.
- Collaborating on cultural issues such as protecting sites, exchanging cultural information, interpreting culture, and protecting artifacts in the parks' collections.
- Sharing research and transferring technology and technical assistance.

In addition, efforts would be made to increase the representation of local American Indians in the parks' workforce.

The joint plan would also comply with the provisions of the California Environmental Quality Act (CEQA) of 1970 (*Public Resources Code* §21000 et seq.) as well as sections 5024, 5024.1, and 5024.5 of the *Public Resources Code*. The CEQA goals with regard to cultural resources are as follows:

- Take all action necessary to protect, rehabilitate, and enhance the environmental quality of California (*Public Resources Code* §21001, subd. (a)).
- Provide the people of the state with clean air and water, enjoyment of aesthetic, natural, scenic, and historic environmental qualities. (*Public Resources Code* §21001, sub d. (b))
- Preserve for future generations . . . examples of the major periods of California history (*Public Resources Code* §21001, sub d. (c)).

The RNSP collections would be managed in accordance with the aforementioned NPS *Management Policies* and *Cultural Resource Management Guideline*, as well as the Museum Properties Management Act (1955), Special Directive 80-1, "Guidance for Meeting NPS Preservation and Protection Standards for Museum Collections," and the NPS *Museum Handbook* (1990).

This joint plan would provide state and local agencies, as well as the general public, with information on the effects the alternatives would have upon cultural resources and describe the ways in which effects, if any, would be mitigated.

Assumptions and Methods for Assessing Impacts

As noted in the "Cultural Resources" chapter of the "Affected Environment" section in this document, a substantial archeological inventory has been accumulated for Redwood National and State Parks. Based upon the results of previous studies, as well as primary ethnographic references and other data obtained during consultations with American Indians, the locations of archeological resources can be reliably predicted. For example, areas of high sensitivity for archeological resources include sources of freshwater along the coast, major and adjoining ridge lines, ecotones between prairie and forest margins, and prominent geographical features. Conversely, dense forested areas and steep slopes tend to be lower in archeological sensitivity. This information, in conjunction with the methodology outlined below, implies that the likelihood of adversely impacting archeological resources during the implementation of any of the actions described in the alternatives is low.

All of the parks' cultural resources, including archeological resources, historic buildings, cultural landscapes, and ethnographic resources, that have not yet been evaluated for listing on the National Register of Historic Places would be considered to be potentially eligible for listing until determined otherwise.

Actions related to one aspect of a cultural resource would not be considered if it was detrimental to another aspect. For example, the treatment of a property that is eligible or potentially eligible for listing on the National Register of Historic Places as a cultural landscape would not be undertaken to the detriment of the resource's ethnographic attributes.

The content of interpretive programs and media addressing ethnographic resources would be developed in consultation with the RNSP cultural resource specialist and American Indians with ties to places being interpreted.

The assessment of impacts on cultural resources followed a three-step process: (1) determining the area of potential effect of the proposed actions; (2) identifying the cultural resources within the area of potential effect that are listed on or eligible for listing on the National Register of Historic Places; and (3) assessing the extent and type of impacts the proposed actions might have upon cultural resources. An impact on a cultural resource occurs if an action has the potential of altering in any way the characteristics that qualify the resource for inclusion on the national register. If a proposed action diminishes the integrity of such characteristics, it is considered to have an adverse effect. Impacts that might occur later than or at a distance from the location of a proposed action are also potential impacts of the action and are considered to be indirect effects.

Potential impacts are based on the best professional judgment and have been developed through discussions with staff from the National Park Service, the California Department of Parks and Recreation, the California state historic preservation officer, and affiliated American Indian tribes.

VISUAL/SCENIC RESOURCES

Impacts on visual resources can be assessed in terms of the existing or proposed visual character of the landscape and the degree to which various actions would change that character. In this respect, visual impact becomes a function of how visually sensitive a landscape is, how much visual change an action might impose on the landscape, and how much visual change is acceptable.

Observer response to visual impacts can be assessed in terms of the landscape's visual

sensitivity and the degree of exposure an observer has to visual change. Will the proposed change be visible? From what distance? For what duration and by how many observers? Will changes have long-term or short-term effects?

Observer response to visual impacts is also a function of the extent to which viewing activities depend on visual quality. For example, observers along a primitive trail or backcountry campsite are more likely to be concerned with visual unity or continuity of a view than viewers in more intensively developed landscape settings.

PUBLIC SAFETY — EARTHQUAKES AND TSUNAMIS

Summary of Regulations and Policies

The National Environmental Policy Act of 1969 requires consideration of all impact topics that would affect public health and safety (sec. 1508.27). 1988 *NPS Management Policies* state that

The saving of human life will take precedence over all management actions. . . . The National Park Service will strive to identify recognizable threats to the safety and health of persons and the protection of property. . . . Where practicable and not detrimental to NPS mandates to preserve park resources, known hazards will be reduced or destroyed.

CDPR policies also require the protection of public health and safety on state parklands.

All areas of the United States have been classified by the International Conference of Building Officials in the *Uniform Building Code* according to their seismic risk. Seismic classifications range from 0 to 4, with zone 4 assigned to areas near major fault systems that are expected to sustain the greatest amount of damage from an earthquake or tsunami. Redwood National and State Parks are classified as zone 3 (most of Del

Norte County) and zone 4 (Humboldt County and southern Del Norte County).

Design requirements to resist the effects of seismic ground motions for new and retrofitted structures are specified in the *Uniform Building Code*. All RNSP structures would be built in conformance with the *Uniform Building Code* to resist the effects of seismic ground motions. Historic structures in the parks were not built to withstand large earthquakes, although some of them have been reenforced during restoration and rehabilitation efforts.

Assumptions and Methods for Assessing Impacts

Earthquake damage depends upon the following variables: magnitude of the earthquake; geological characteristics of the site; location of the earthquake; severity and duration of ground shaking; ground response according to soil types; soil structure interaction; building code provisions in force at the time of the building's design; building construction type, configuration, and size; quality of construction; and proper building maintenance by the owner once the building is occupied (California Department of Conservation 1995, p 33-34).

With the exception of the permanent campground proposed at Freshwater Lagoon Spit in alternative 4, no new facilities would be constructed in the coastal high hazard zone as defined in the NPS *Floodplain Management Guideline* (July 1, 1993) and the tsunami run-up height delineated by the National Oceanic and Atmospheric Administration and others.

To assess the potential impacts from a large earthquake, a literature search was conducted on the earthquake hazards of the north coastal area. Staff at the California Department of Conservation, Division of Mines and Geology; Humboldt State University, Humboldt Earthquake Information Center and Department of Geology; U.S. Geological Survey; and Humboldt County Building Department were queried about the risks and possible impacts of earthquakes.

IMPACTS OF ACTIONS THAT ARE COMMON TO ALL ALTERNATIVES

IMPACTS ON NATURAL RESOURCES

Air Quality

There would be some short-term, localized, minor impacts on air quality resulting from dust particles and exhaust fumes during the construction, removal, relocation, or improvement of roads, trails, buildings, and other facilities, and during watershed restoration activities under all of the alternatives. The effects on air quality would be localized and temporary and would not exceed state or federal air quality standards.

Prescribed fires for managing old-growth forests, second-growth forests, and prairies would result in impaired visibility and minor adverse impacts on air quality. Localized, elevated PM_{10} (particulate matter less than 10 micrometers in diameter) levels would quickly dissipate (settle out) after the completion of the controlled burns.

Vehicles driving on the unpaved roads (Davison, Gold Bluffs Beach, Cal-Barrel, Howland Hill, and Walker Roads, the South Operations Center access road, portions of the Bald Hills road and Coastal Drive, and the Tall Trees access road) would continue to raise dust during the dry seasons. Dust particles reduce visibility and settle on roadside vegetation. Regular road maintenance, dust suppression activities, and/or improvements would reduce the amount of dust on these roadways.

Conclusion

There would be short-term, localized minor disturbances in air quality from the construction, removal, relocation, or improvement of roads, trails, buildings, and other facilities; ongoing RNSP maintenance activities; prescribed fires; and watershed restoration activities. No long-term impacts would result from any proposed actions, and no cumulative impacts on air quality would be anticipated.

Soils

The continued use, maintenance, and management of RNSP roads, trails, parking and picnic areas, buildings, and utility systems would result in ongoing minor disturbances to soils and topography, such as erosion and soil compaction. Regular road use and maintenance would cause road aggregate and dust particles to cover adjacent roadside soils and vegetation, which could harm vegetation and impact scenic qualities. Foot traffic would continue to cause compaction and soil loss on established and social trails and near visitor and interpretive facilities. Soil compaction and erosion on mountain bike and horse trails would be more severe than on hiking trails and would continue under all alternatives.

Watershed restoration through disturbed lands restoration and erosion prevention treatments would help restore lower Redwood Creek and its tributaries, other streams, aquatic species, and vegetation, including the redwood forest, by reducing erosion and sedimentation in the parks.

Impacts of Watershed Restoration Outside Redwood Creek Basin

The disturbed lands restoration program at Redwood National and State Parks is currently being done primarily on national parklands in the lower portion of Redwood Creek basin. If during the life of this plan other state and national parklands were targeted for similar restoration work, the impacts would be similar to those summarized below and further described in the discussion on soils in the chapter on "Impacts of Implementing Alternative 1 — The Proposed Action." At this point, the degree of impact from logging activities on other parklands or the beneficial impacts that would be derived from restoration work have not been quantified. These analyses would occur before implementing restoration work elsewhere in the parks.

Road benches and stream crossings could fail before watershed restoration activities in Redwood Creek basin and elsewhere were completed, resulting in increased sediment inputs into Redwood Creek, its tributaries, and other streams. This could cause the burial of topsoil and moderate and severe adverse impacts on aquatic resources, vegetation, water quality, and cultural resources. (For more information see related topics in this "Environmental Consequences" section of this document.)

Conclusion

The continued use and maintenance of RNSP roads, trails, parking and picnic areas, buildings, and utility systems would result in localized minor increases in soil erosion and compaction. Soil disturbances on mountain bike and horse trails would be more severe than on hiking trails and would continue to occur. Watershed restoration activities upstream of and on parklands in Redwood Creek basin and elsewhere would have a beneficial impact on streams, aquatic species, and vegetation by reducing erosion and sedimentation.

Cumulative Impacts

Logging activities that occurred before the expansion of Redwood National Park in 1978 and ongoing logging and other land use activities upstream of the national park boundaries have had a major adverse cumulative impact on the physical and biological functioning of Redwood Creek ecosystems. Downstream impacts from the increased sediment loads include increases in the volume of stored sediment (causing stream-bed aggradation), increased bank erosion, and channel widening. Much of the sediment that is eroded is stored in the channel bed where it fills in pools and enlarges gravel bars to accommodate the influx of sediment (Hagans, Weaver, and Madej 1980). Wide-scale erosion and sedimentation associated with roads affect the volume of channel-stored sediment for many years (decades to centuries) following the land disturbance.

Logging activities that occurred within the park expansion area before it was added to the national park in 1978 have had a major adverse impact on the tributary streams and hillslopes of the Redwood Creek basin. Watershed restoration within the national park would have a major beneficial impact of restoring natural hydrologic functions and drainage patterns, reducing concentrated runoff, erosion, and sedimentation into the tributaries of Redwood Creek, and would assist in the overall recovery of the Redwood Creek ecosystem. Upstream logging activities would continue to have major adverse impacts on resources in and adjacent to the main stem of Redwood Creek. Based upon total road miles, if the erosion potential per mile upstream of the park were similar to the erosion potential per mile within the park, the upstream road-related erosion potential would be roughly six times greater for areas upstream of the national park in the Redwood Creek basin. More than 70% of the sediment transported by Redwood Creek originates from areas upstream of the park (Madej 1992).

Cooperative watershed management activities with upstream landowners proposed under all of the alternatives would have a major beneficial impact of reducing the potential sediment loads and protecting riparian areas along Redwood Creek if restoration work were aggressively pursued. With aggressive programs and time, the potential for major adverse impacts on downstream national park resources from excess sediment would be greatly reduced.

Water Quality

Cumulative Impacts

Cumulative impacts on the water quality in RNSP streams would be caused by point and nonpoint sources of pollution and include runoff from logging, road-building, grazing and other ranching activities, wastewater disposal, and petroleum runoff from paved roads, which have resulted in elevated turbidity and contaminants in some of the parks' streams. Logging activities

and levee construction in Redwood Creek basin have adversely impacted water quality in lower Redwood Creek. However, ongoing watershed restoration activities would have the beneficial impact of reducing the sediment-related water quality concerns over the long term.

Floodplains and Wetlands

Impacts of Watershed Restoration

The restoration of the original prelogging landforms in the Redwood Creek basin would restore the original drainage patterns and the original hydrologic functions. Removing fill from stream channels would increase the amount of intermittent and perennial riverine and palustrine wetlands. This would be a beneficial impact on wetlands associated with the intermittent and perennial stream channels in which natural drainage patterns were restored.

Small areas of wetland plants and soils would be disturbed by watershed restoration activities. These would be localized, short-term adverse impacts. Most wetlands that would be adversely affected by watershed restoration would be small isolated wetlands that have formed since road construction in drainage ditches and at partially plugged culvert inlets, in areas that were originally uplands, and in headwaters of streams. Although these "artificial" wetlands could be removed during restoration, there would be a greater long-term benefit for intermittent and perennial streams from restoring original drainage patterns.

The restoration of wetlands in higher position on slopes and at higher elevations would have beneficial impacts. These wetlands tend to be intermittent, and their primary functions and values are amphibian habitat and stream regulation. Channels farther downslope are more likely to contain a permanent stream and have a greater range of wetland functions and values. Both intermittent and perennial streams reduce the severity of floods by regulating streamflow; they

also capture sediment before it is delivered to wetlands downstream.

Most in-park watershed restoration projects uncover sections of perennial and intermittent stream channels buried under road fill. The restoration of these perennial stream channel reaches would locally increase habitat for anadromous and resident salmonid fishes. Following the restoration of stream channels, frogs and salamanders inhabiting road ditches and small ponds would be displaced initially but would likely recolonize the restored intermittent or perennial riverine wetland habitat.

Fish and amphibians that live downstream from watershed restoration sites would directly benefit from the restoration of original drainage patterns that created the streams in which the fish live and spawn. There would be indirect benefits to fish and amphibians from reducing the threat of continued habitat loss due to large volumes of sediment moving downstream and downslope after a road failure.

The rearrangement of log jams, the placement of instream structures for fish passage or fish cover, or other habitat improvement projects would have temporary adverse impacts in the stream channel and on adjacent banks during channel work, but a long-term beneficial impact from the restoration of wetland habitat values for aquatic wildlife and fish.

Impacts of Estuary Restoration

There would be a long-term benefit on the Redwood Creek estuary from reducing the sediment that enters the estuary. The reduction of sediment would be proportional to the area of watershed that was treated to control erosion; to the distance upstream of the estuary; and to the intensity and duration of storms that transport sediment down the creek. Very intense storms of long duration would move greater volumes of sediment longer distances than less intense storms of shorter duration. The deposition of a large volume of sediment into the estuary would reduce the ability of the estuary to attenuate

floods; increase the turbidity of estuary water, thus decreasing the suitability of the habitat for some aquatic species; and reduce the total amount of available aquatic habitat. The reduction of wetland vegetation in areas that fill with sediment might make some areas less visually appealing. The loss of wetland vegetation would reduce populations of wildlife such as birds and amphibians that use the estuary. These adverse impacts would be reduced through watershed restoration upstream but would not be eliminated because of the ongoing timber harvest and road-building outside of the parks.

The removal of accumulated sediments from the Redwood Creek estuary and adjacent creeks to improve anadromous salmonid habitat would cause minor temporary adverse impacts on the Redwood Creek estuary and adjacent creeks. The placement of structures related to improving habitat for these fish would also have minor temporary adverse impacts on stream channels and streambanks.

Using historical accounts and photographs of the estuary taken since 1948, staff have estimated that estuarine habitat for fish has been reduced by as much as 75% of its original extent, a long-term adverse impact on wetlands associated with the estuary.

Impacts of Fire Management

Wetlands tend to be less susceptible to fire than upland environments and are usually not directly affected by unplanned fires. Wetland vegetation is usually not directly affected by wildland fires because wet areas do not burn well. Fire suppression, particularly for wildland fires, creates direct and indirect effects on wetlands. Indirect effects include equipment and personnel crossing stream channels and riparian areas and trampling wetland vegetation and soils. Cutting fire lines for suppression efforts would directly disturb wetland soil and vegetation, but lines are cut at right angles to streams to confine these impacts to as small an area as possible. Suppression of large catastrophic wildland fires results in adverse impacts on wetlands, including larger

stream channels. Intense heat from catastrophic wildfires would remove upland vegetation and create patches of bare soil that could erode in heavy rains and cause sediment to move into riparian areas downslope and plug stream channels, an adverse effect on wetlands.

A prescribed fire program that includes wildland fire use makes it easier to avoid adverse impacts on wetlands through planning the location and conditions (prescription) for the burn. Implementing a program of regular prescribed fire and wildland fire use would reduce fuels so that unnaturally hot fires do not occur. Wetlands and riparian areas downslope of prescribed fires would be affected by excessive upslope erosion if a prescribed fire created an unnaturally hot fire. Such fires would result from long periods of fire suppression and fuel buildup that allow fires to burn hot enough to destroy all organic matter and result in bare mineral soils.

Impacts of Prairie Restoration

There would be no direct impacts on wetlands from the restoration of prairies, including prescribed fires in the upland prairies of the Bald Hills or cutting of Douglas-fir.

Impacts Related to Artificial Impoundments

The maintenance of catchment basins along the Highway 101 bypass would cause some temporary minor adverse impacts on artificial wetlands. However, naturally occurring wetlands and aquatic species downslope would benefit in a major way by the protection provided by these basins from the possible adverse effects of sedimentation and spilled contaminants.

Impacts of Cultural Landscape Management

The mouth of the Klamath River might be determined eligible for inclusion on the National Register of Historic Places for its ethnographic significance to the Yurok Tribe. National register listing of this property would likely have minor indirect benefits on marine intertidal and estuarine wetlands at the mouth of the river

because activities that affect water circulation or alter the banks of the river or the sandbar in the Klamath River estuary would have to be evaluated for possible adverse effects on a significant cultural property.

Impacts Related to Visitor Use

There would continue to be minor direct adverse impacts on wetlands from visitors walking in areas adjacent to trails near stream crossings and in low places, and in the vicinity of developed areas and prominent visitor use areas including the following: the Crescent Beach coastal ponds, streambanks and riparian areas adjacent to Mill Creek near Stout Grove and the Mill Creek campground, Prairie Creek near the Elk Prairie campground and the Wolf Creek Education Center, the stream at Fern Canyon, the banks of Redwood Creek near the Tall Trees Grove and other places where the Redwood Creek trail approaches the creek, estuarine wetlands near the Redwood Information Center and the Redwood Creek estuary, and riparian areas and wetlands at Davison Ranch.

Most impacts on wetlands that could be attributed to visitor use would be impacts from development and maintenance of facilities to serve visitors. These facilities would primarily be roads, bridges, trails, and trailheads.

Impacts on wetlands related to camping activities would primarily be short term but repeated adverse impacts from visitors walking in nearby wetland areas. Camping activities at Gold Bluffs Beach, Elk Prairie campground, Jedediah Smith campground, and Mill Creek campground could impact nearby wetlands (Fern Canyon, Prairie Creek, Mill Creek, and the Smith River). These impacts would be mitigated by discouraging social trails in wetland areas through camping guidelines and signs and by constructing boardwalks.

New campgrounds or campsites generally would not be constructed in wetland areas because these offer less desirable camping than dry places. Even if wetter sites were used only during the

dry season, puddling and flooding in the wet season might damage facilities and increase maintenance costs.

Sewage treatment facilities associated with new campsites, campgrounds, and other facilities would be large enough to avoid water quality impacts on nearby wetlands. Improper sewage disposal at primitive campsites would indirectly affect streams or wetlands nearby and might create adverse impacts on the aesthetic values of wetland areas. This would not likely be a problem because toilet facilities in those areas would be set back at least 150 feet from any perennial stream or wetland.

Trails through wetlands are generally limited to as short an area as possible because walking or riding a horse or mountain bike in wet areas is either unpleasant, impossible, or dangerous for most users. (Although some mountain bikers seek a more adventurous experience, these experiences are incompatible with the experience the parks seek to provide for all users on a trail.)

Trails would be routed around wet areas or cross streams at right angles to minimize the amount of wetland affected and to provide a better hiking or riding experience for most visitors. Foot trails would include bridges to cross larger streams, avoiding adverse impacts on wetlands and stream channels from the placement of fill. Sections of established trails that cross wet areas are being rerouted throughout the parks as funding permits. The rerouting of trails around wetlands would restore hydrologic conditions (including flow and circulation patterns and original ground contours) and would improve the aesthetic and recreational values of wetlands and thus the visitor experience. Wetland vegetation would likely reestablish naturally in most areas after trails were rerouted. There would be minor localized adverse impacts on wetlands from trail repair when small amounts of fill was placed in drainages or wet areas.

Boardwalks would be used when a trail would be constructed for the express purpose of providing access to wetlands and interpreting wetland

functions and values such as wildlife habitat. Boardwalks would also be considered if wetlands could not be avoided for a trail route. Boardwalks are expensive to construct and maintain. Boardwalks in some wetland sites, such as the mouths of streams, stream channels, or tsunami zones, might also be subject to seasonal or occasional flooding. Engineering and construction costs for such boardwalks would likely outweigh the recreational benefit for visitors. Boardwalks might also create direct adverse impacts on wetlands from shading of wetlands and from interrupting water circulation patterns. Visitors using the boardwalks might disturb nesting waterfowl, an indirect adverse impact on wetlands. This impact could be mitigated by providing blinds from which to see wildlife or closing the trail to public use during particularly sensitive times. Interpretive signs about the functions and values of wetlands would inform visitors about these values, a minor indirect benefit for wetlands.

Trails in some locations might require drainage structures such as culverts or ditches. Culverts would be placed at the same elevation as the adjacent aquatic area to ensure that water movement through the wetland and the passage of aquatic animals was allowed. Special attention would be given to the needs of migratory and resident salmonids if culverts must be laid in stream channels.

There would be minor repeated adverse impacts from visitors walking on shoreline vegetation at Freshwater Lagoon adjacent to Freshwater Lagoon Spit; from runoff from exposed soils where vegetation has been reduced from being walked on; and from petroleum products from motor vehicles parked along the highway and boat motors and personal watercraft in the lagoon.

Impacts from Vehicles on the Beach

Direct adverse impacts on sandy shoreline below high tide line from commercial surf fishing or other permitted uses on the beach at Freshwater Lagoon Spit, Crescent Beach, and Gold Bluffs

Beach would not be significant because wave and tide action regularly remove any traces of visitor use in this type of wetland.

Some visitors consider the vehicles on the beach as visual and auditory intrusions on the sandy ocean shoreline. This would be an adverse impact on aesthetic and recreational values of a wetland. These adverse impacts from vehicles associated with commercial surf fishing on Gold Bluffs, Crescent, and Freshwater Lagoon Spit beaches would continue.

Impacts Related to Visitor Access and Circulation

The continuing maintenance of roads, including the Tall Trees access road, Cal-Barrel Road, Davison-Gold Bluffs Beach Road, and Howland Hill Road, which were not constructed to modern standards, might result in adverse impacts on adjacent wetlands if the roads are widened or larger culverts are installed, or if the roads fail before these improvements are made. Maintaining these roads in their current condition would eventually result in failures due to consequences from moderate or large storms.

Impacts on wetlands from road maintenance might include short-term minor adverse impacts on small wetlands from maintaining ditches; from maintaining and replacing culverts; and from petroleum from vehicles leaking onto paved road surfaces and running off into adjacent ditches, some of which are wetlands.

Conclusions

Logging activities before national park expansion in 1978, and activities such as logging, road construction, development, and grazing upstream of national park boundaries, have had an adverse impact on river morphology, water circulation, and sedimentation in the lower Redwood Creek valley and estuary. These activities have increased erosion and sedimentation into area streams, which has resulted in channel widening and aggradation, increased streambank erosion and peak flows, the destruction of pool-riffle

sequences, decreased stream discharge during the summer in Redwood Creek and its tributaries, and the damage or destruction of streamside vegetation and aquatic habitats. Watershed restoration would reduce or eliminate these adverse impacts, with minor erosion occurring for one rainy season following restoration until stream channels adjust to their original condition and vegetation recolonizes bare ground.

The removal of abandoned roads within the parks and roads no longer needed for management on private lands would result in long-term benefits for intermittent and perennial riverine wetlands adjacent to and crossed by roads. Many of the wetlands associated with roads were created when the roads blocked natural drainage and allowed water to remain in an area instead of draining. In many of these places, especially high in the drainage, where the road would be removed and drainage restored, the wetland would disappear.

Impacts on the Redwood Creek channel configuration, floodplain, and estuary that are caused by upstream logging activities would continue to adversely affect the lower river for some time after the watershed restoration program was completed. Implementing a coordinated resource management plan to reduce erosion from private lands in the upper basin and road removal activities within and upstream of the national park would increase chances of preventing additional sediment from moving into Redwood Creek and decrease adverse impacts on the main channel and floodplain from future floods. However, impacts from past floods and land use such as streambank erosion, channel widening, increased sediment storage (infilling of the streambed with sediment), and the associated loss of aquatic habitats and streamside vegetation would decrease as restoration proceeds, but would persist until the excess sediment is flushed through the river system. Geologic research by RNSP staff and others indicates that this process could take decades to centuries to be completed. The benefit for the basin would be proportional to the acreage of lands on which

improved watershed management techniques were instituted. There would be a long-term benefit to the estuary, which would also be proportional to the acreage restored, from reducing the sediment that entered the estuary.

The levees along lower Redwood Creek have had a greater adverse effect on the water circulation and sediment deposition in the Redwood Creek estuary than logging activities, so the differences in the impacts on the estuary from the watershed restoration activities are not discernible between the alternatives presented in this document. The levees have had the beneficial impact of providing flood protection to numerous properties along the river that had historically been inundated during floods. Since 1968 the levees have also prevented flooding in areas that previously may have been periodically flooded. The levees have also had the significant adverse impact of altering the natural physical and biological processes in the estuary as discussed under the impacts of implementing the no-action alternative (alternative 2) section. Partial levee removal and watershed restoration activities within and upstream of the national park would have a major beneficial impact on the lower Redwood Creek valley floodplain.

There would be minor negative impacts for small areas of wetlands from the construction, maintenance, and use of trails, roads, camping areas, and buildings and from fire suppression activities.

Cumulative Impacts

Cumulative impacts on wetlands would include adverse impacts from upstream land uses and the alteration of the Redwood Creek estuary by channelization and localized development. The cumulative benefit for the Redwood Creek watershed would depend on the extent of restoration within and outside of national park boundary and the extent of restoration in the estuary.

Several past activities have significantly and cumulatively altered the water circulation patterns and flow regime in Redwood Creek,

reduced the water depth in the estuary, and filled in creeks that once entered the estuary. These activities include (1) the channelization of the creek by flood control levees constructed in 1968, (2) the manipulation of water levels (including uncontrolled and controlled breaching) to reduce the flooding of adjacent agricultural lands and private roads and protect the Redwood Information Center, (3) the diking and draining of original wetlands for residential and agricultural development, (4) gravel mining in Redwood Creek, (5) the construction of Highway 101, (6) urban development in the community of Orick, and (7) the maintenance of the levees by removing riparian vegetation growing within the levees. Over time, ongoing watershed and estuary restoration activities in and upstream of the national park in Redwood Creek basin would reduce these impacts on the floodplain and wetlands near the mouth of Redwood Creek.

There would be cumulative minor adverse impacts on wetlands from constructing, maintaining, and using roads, trails, camping areas, and other facilities.

Threatened and Endangered Species

Introduction

Endangered animal species have been grouped by the general habitat type each species occupies to determine the likelihood that a species would be affected by a proposal in general terms, such as watershed restoration or recreational use of the parks. There are no proposals in the joint plan that would affect offshore rocks or waters that are habitat for some threatened and endangered species. Neither sea turtles nor Steller sea lions are known to use RNSP beaches or rocky shoreline for breeding or resting. Therefore, no direct impacts would be anticipated on these marine animals. An increase in salmon and steelhead in RNSP rivers and streams would have a minor indirect long-term beneficial impact on Steller sea lions, which eat these fish.

Listed or proposed threatened or endangered species that are known to occur in the parks and any designated critical habitat, are grouped as

- terrestrial forest nesting birds and designated critical habitat (northern spotted owl, marbled murrelet, and critical habitat for marbled murrelet)
- other birds (bald eagle, peregrine falcon, brown pelican, snowy plover)
- fish (tidewater goby, Klamath Mountains province steelhead, Northern California steelhead, and coho salmon)

Although tidewater gobies have not been seen in the Redwood Creek estuary since the early 1980s and snowy plovers have not been observed to use RNSP beaches for nesting, impacts on the habitat for these species have been assessed because potential habitat exists in the parks, and there are no data to confirm that these species could no longer exist here. Plovers are known to use nearby beaches in the region for nesting.

Terrestrial forest nesting birds and fish are the two groups most likely to be affected by proposals in the joint plan. Ongoing actions and proposals in this joint plan would not affect the marine foraging habitat of marbled murrelets.

Brown pelicans and peregrine falcons potentially would be affected, primarily by actions that would affect the coastal areas of the parks — the restoration of the Redwood Creek estuary and the recreational or commercial use of coastal areas and facilities including Freshwater Lagoon Spit, Gold Bluffs Beach, and the Redwood Information Center. Snowy plover nesting habitat would also be affected by these proposals, but there would be no direct impacts on plovers, which have not been observed to nest in the parks in recent years.

Bald eagles would be affected primarily by resource management actions that affect potential foraging, nesting, and roosting sites including watershed restoration and vegetation management. Recreational use of the parks and operations such as trail construction and facility

maintenance would likely have only minor effects, if any, on bald eagles. However, if prey abundance increases in Redwood Creek and eagles establish breeding territories in the future, an increase in human use of this area (especially fishing, swimming, and boating activities) would likely have negative effects on nesting bald eagles.

Impacts of Noise and Disturbance

Northern spotted owls, marbled murrelets, bald eagles, western snowy plovers, and peregrine falcons might be disturbed by noise levels that exceed ambient noise levels near nest sites or breeding territories. Noise and disturbance impacts on owls and murrelets are discussed in detail in a separate section.

The U.S. Fish and Wildlife Service has established 0.25 mile as the distance at which northern spotted owls or marbled murrelets may be disturbed by human activity and noise greater than ambient levels. If there is suitable owl or murrelet habitat within a 0.25 mile radius of a project that might create noise or disturbance, RNSP staff might be required to initiate informal consultation under section 7 of the Endangered Species Act.

Human presence in an area might create disturbance without creating intense noise. For example, corvids (jays, crows, and ravens), and gulls are attracted by human presence. Corvids prey on nestlings and eggs of northern spotted owls and marbled murrelets, although there are no direct observations within the parks. Increasing human use of the backcountry, especially in old-growth forests, might increase the risk of predation on nests of marbled murrelets and northern spotted owls. New roads, trails, trailheads, and campsites might also attract corvids, which might then prey on nearby marbled murrelet and northern spotted owl nests.

Impacts of Habitat Modification

Habitat might be modified directly (removing trees used by forest bird species for nesting), or

indirectly (removing the overhanging vegetation that creates shade over a stream used by fish and altering water temperatures or creating excessive openings in canopy adjacent to nest sites, thus increasing nest visibility).

Beneficial impacts from habitat modification would result when areas damaged by previous timber harvesting or road construction were restored to approximately predisturbance conditions. Restoring naturally occurring ecosystem conditions or processes such as drainage patterns or fire has a long-term positive effect on reestablishing native plant species composition, and thus a beneficial long-term effect on wildlife habitats.

There might be short-term or temporary localized adverse impacts on habitats from the initial stages of ecological restoration projects, such as (1) the removal of small trees in second-growth forests to encourage faster growth of remaining trees, (2) the removal of small trees during watershed restoration, (3) smoke from prescribed fires that filters into forests, (4) minor increases in turbidity in streams from soil erosion in the first rainy season following watershed restoration, and (5) burning large woody debris and snags during prescribed fires.

The removal of vegetation might directly affect wildlife that is occupying the vegetation, e.g., removing a tree with a nest or a potential nest site. The removal of vegetation might also have indirect adverse effects on a species by decreasing the amount of suitable habitat available or by altering the suitability of habitat — because of thinning the vegetation or changing the amount of canopy cover or increasing the attractiveness of the area to predators.

Construction-Related Impacts

Construction impacts would include the disturbance of soils and vegetation through clearing. The acreages of vegetation or the types of soils and vegetation that might be disturbed as a result of proposals in this joint plan would be analyzed during future detailed planning. Impacts on listed

or proposed threatened and endangered species from the removal of vegetation would also be included in the environmental analyses that would accompany future detailed planning when site-specific locations for visitor and RNSP administrative facilities are selected.

Direct effects of construction would include noise and excessive disturbance that might cause an animal to move away from a construction site or other sources of noise. Less frequent and short-term disturbances would normally be expected to have fewer adverse impacts than more frequent and longer-term disturbances because many animal species would return to a disturbed area if the habitat remains.

Construction might require grading or dredging of soils. Bare soils are susceptible to erosion and runoff until revegetation occurs. Runoff into streams reduces water quality and increases sediment, thus decreasing the suitability of spawning habitat for the anadromous threatened and endangered fish. Erosion and runoff from bare soils are controlled by using techniques such as mulching with native materials (to reduce introduction of weeds or nonnative plants) and placing matting and erosion control blankets on land and structures in streams to reduce adverse impacts of sediment in salmonid spawning streams.

Impacts from Human Use

The effects on wildlife from human activities involve a complicated relationship between individual behavior of animals nesting in the vicinity, the timing of the human activity, the suitability of the habitat, and the frequency, magnitude, and abruptness of the human activity. Tolerance of human use in an area is probably a learned behavior. Some species are more tolerant of human activity than others. Some species are intolerant of human disturbance and might not recolonize an area for some time after disturbance ceases. Other individual animals might be displaced from a particular area and unable to colonize new areas because the habitats are already saturated.

The potential for creating the greatest disturbance to bird species occurs during egg laying and early incubation. Reproductive failures due to human harassment are more likely to occur in marginal habitat than in ideal nesting, denning, or foraging habitat (Knight and Gutzweiler 1995). A disturbed nesting bird might temporarily leave a nest unprotected, thus increasing the chance of exposure to weather or predation on eggs and nestlings.

Marzluff et al. (1994) found in a review of published literature and several national bird censuses that gulls and corvids have increased in abundance across the country and are highly correlated to increase in human populations. These species are known to prey on eggs and nestlings of marbled murrelets.

Establishing primitive zones in many places throughout the parks would provide core protected areas on suitable habitats with minimal human disturbance.

Impacts of Watershed Restoration

No significant, direct, long-term adverse impacts on listed wildlife or fish species would be anticipated as a result of watershed restoration projects. Given the available information, no marbled murrelet or northern spotted owl nesting habitat is expected to be lost. Significant direct short-term adverse impacts on marbled murrelets and northern spotted owls would be avoided in most areas by working outside the noise restriction periods established by the U.S. Fish and Wildlife Service to protect nesting birds (February 1 through July 9, for noise-related effects only, and July 31 if habitat is affected, for northern spotted owls; March 24 through September 15 for marbled murrelets). During any one year, there might be minor effects — but not adverse effects — on marbled murrelets on up to 300 acres of suitable habitat from noise disturbance.

Moderate indirect adverse impacts on coho salmon and other anadromous fish from erosion of bare soils into spawning streams following

restoration would be avoided by completing restoration work before the onset of the rainy season. Many watershed restoration sites would be in headwaters of streams where flows are intermittent rather than in portions of the perennial streams inhabited by fish or used by the fish for spawning. Any potential adverse impacts from sedimentation would occur in the first winter rainy season following restoration. After one rainy season, stream channels adjust to their original condition and enough vegetation colonizes bare ground to minimize erosion and sedimentation.

Northern spotted owls and marbled murrelets would benefit from the eventual reduction in forest fragmentation that would result after the forest expands into the former road corridors.

The long-term benefit for the murrelets would be realized in about 100 years, when the first 500 acres of treated forest grows back to about half its potential height and develop the large lateral branches required for nest platforms. Owls might benefit from forest regrowth in as little as 40 years because they do not require the large lateral branches for nest platforms.

Watershed restoration projects would not result in a major short-term reduction of overall spotted owl nesting habitat or a significant long-term increase because the size of individual projects would be small in relation to total available habitat in any given restoration area. Watershed restoration would result in minor long-term indirect benefits for owls and murrelets through restoration of natural ecosystem functions and processes.

Watershed restoration would result in short-term and long-term benefits for coho salmon and other anadromous fish from reducing sediment into stream channels and restoring landforms and drainage channels. Sediment fills in the deep cooler pools used by fish in summer when water temperatures rise. Fine sediments smaller than 8 millimeters in diameter fill in the small spaces between gravel particles, making egg survival more difficult because dissolved oxygen cannot

reach the eggs. Fine sediment can also physically block the emerging fry. Reducing the sediment delivered to Redwood Creek through watershed restoration projects would allow natural stream processes to sort the particles and develop the pools, riffles, and spawning habitat required by salmonids. Watershed restoration would result in a direct benefit for anadromous salmonids by restoring the conditions that encourage the growth of streamside vegetation that maintains cooler water temperatures and provides shelter from predators.

Watershed restoration projects in Redwood National and State Parks have been curtailed since 1994 because of noise restrictions to protect northern spotted owls and marbled murrelets during their respective breeding seasons. Because no work that generates sustained noise above local background levels is permitted within 0.25 mile of suitable nesting habitat during nesting season, projects have tended to be short in duration, resulting in less work completed each year in any given area. When noise restrictions are combined with restrictions on large-scale ground disturbance during the rainy season to prevent erosion and sedimentation that may affect coho salmon and other anadromous fish spawning habitat, the effective season for watershed restoration work is shortened to as little as four weeks, from September 16 through October 15 of any given year. Work dates after October 15 must be negotiated with National Marine Fisheries Service. If spotted owl habitat but not marbled murrelet habitat would be affected by noise disturbance only, without habitat alteration, watershed rehabilitation projects can begin as early as July 10, with a potential season of 14 weeks. The onset of heavy rains in mid-October is not unusual in northwestern California, resulting in a four-week season for restoration work in some areas during some years.

Watershed restoration would have greater benefits for coho salmon and other anadromous fish than for spotted owls and marbled murrelets. Fish would benefit from restoration because their spawning and rearing habitat would suffer direct

short- and long-term adverse impacts if abandoned roads were to fail and deposit sediment into stream channels. The degree of adverse impacts on coho salmon and other anadromous fish depends on how many potentially damaging roads that can contribute large quantities of sediment to critical streams remain untreated. It is likely that a major storm capable of producing significant road failures, with accompanying significant adverse impacts on coho and steel-head stream habitat, will occur in the next two decades. If watershed restoration is not done, it would take about twice that long (40 years) for the forests surrounding abandoned logging roads to develop into suitable owl nesting habitat.

It would take almost 10 times that long (200 years) for the forests to develop suitable murrelet nesting habitat. Without watershed restoration, suitable nesting habitat would eventually develop, but in the time required for nesting habitat to develop without management intervention, anticipated road failures in unrestored watersheds would continue to result in major adverse impacts on coho salmon and other anadromous fish from sedimentation of spawning streams. The long-term benefits of completely removing all unneeded roads in the national park and providing maximum reduction in erosion from lands upstream of the park greatly exceed the short-term adverse impacts of doing the work.

Developing and implementing a coordinated resource management plan with large timberland owners in the Redwood Creek basin upstream of the national park would increase the chances of obtaining outside funding and new appropriations for watershed restoration. Resultant benefits for coho salmon and other anadromous fish in Redwood Creek would depend on how many miles of roads upstream of the park could be treated, the location of treatment areas in relation to important fish habitat, and over what period of time.

Impacts of Vegetation Management

Vegetation management activities, including fire management, management of second-growth

forest, and prairie restoration, would likely have minor short-term adverse impacts on northern spotted owls and marbled murrelets from noise and disturbance. No direct or long-term adverse impacts on designated critical habitat for marbled murrelets would be anticipated under any vegetation management action. There would be little direct modification of suitable owl nesting habitat or murrelet habitat that is not designated critical habitat. The extent to which northern spotted owl habitat would be affected by thinning second-growth forest areas is not known at the present but would be determined when RNSP staff develops a plan and site-specific prescriptions for treatment of the forests. The effects of second-growth forest management would be analyzed in the environmental document that will accompany the second-growth forest management plan. Mitigation used to protect owls and murrelets might involve timing of projects to avoid the nesting periods, and/or other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

Several factors contribute to the uncertainty about the effectiveness of silvicultural treatments or forest manipulation in second-growth forests to restore habitat characteristics suitable for murrelet nesting in less time than that required for second-growth forest stands to develop those characteristics without treatment. Some of the uncertainty is due to the lack of detailed information on the lives of marbled murrelets — they are small and secretive by nature, and they move between offshore feeding grounds and dense, tall coastal forests (Paton 1995). Also uncertain is the effectiveness of silvicultural treatment to recreate habitat characteristics suitable for murrelet nesting.

Silvicultural techniques have been developed for commercial timberlands, primarily to increase the size of merchantable timber with the intent of continued commercial timber harvest on a rotation schedule rather than to reattain old-growth characteristics. Silvicultural treatments are more likely to produce suitable spotted owl nesting habitat in a shorter time because owls have less

restrictive nesting requirements and are known to nest in advanced second-growth forests.

The relative effectiveness of individual silvicultural techniques, such as thinning small trees to accelerate growth of remaining trees, depends on the site potential at a specific treatment location, as well as on unpredictable factors such as the availability of funding, the weather, and catastrophic events such as fires or windstorms. (The site-potential tree height or tree girth is the average maximum height or girth for trees given the local growing conditions and is based on species-specific site index tables developed by foresters.)

A benefit for owls and murrelets would be anticipated from silvicultural treatments to second-growth forests that restore old-growth characteristics including multistory canopy, mixed species stands, snags, and large down trees and logs. Of these characteristics, mixed species stands would be restored sooner than snags or a multistory canopy because tree species diversity would be attained through removal or introduction of selected species. The removal of individual trees to replicate naturally occurring tree species diversity would be possible in the short term, but it is not known how many treatments or multiple entries into a stand would be required to sustain the desired tree species diversity over the long term. The restoration of mixed species stands would not benefit owls or murrelets until the individual trees in a stand grow large enough to become suitable nest trees.

Major benefits to murrelets from second-growth forest management would not be realized until the trees are large enough to have suitable nesting platforms or acquire characteristics such as masses of lichen or moss that can provide suitable nest platforms. Research suggests that stand structure (species composition, large branches, moss) is more important than stand age to murrelets (Hamer and Nelson 1995), but forests with suitable stand structure are estimated to be at least 250 years old. The average age of forest stands where murrelets are known to nest

in the Pacific Northwest is calculated to be about 500 years (USFWS 1997).

Impacts of Fire Management

General impacts from the fire management program would include localized short-term adverse impacts on nesting northern spotted owls and marbled murrelets from drifting smoke, and noise and disturbance from equipment and personnel. Adverse impacts would be greater for owls and murrelets when the smoke could travel into the old-growth forest canopy. Fire management might have a greater effect on owls than murrelets because owls live farther inland where the risk of wildfires is greater because of drier conditions. Adverse impacts on murrelets and owls from prescribed fires for management purposes would be avoided or reduced by burning outside the murrelet breeding season and by adhering to the schedule of allowable burn days established by the regional air quality board to reduce the adverse impacts of drifting smoke.

Dense stands of small diameter trees in some second-growth forests are at risk for large damaging fires because of the high volume of fuels. Such a fire could move into adjacent suitable habitat for murrelets and owls with direct adverse impacts on the habitat from fire, smoke, and fire suppression activities. Suppression activities that would create direct adverse impacts on owls and murrelets would include cutting large trees to create a fire break or to fell a tree that is burning. Direct modification of suitable owl and murrelet habitat from fire suppression would likely be limited in extent and infrequent. No major direct adverse impacts on marbled murrelet critical habitat would be anticipated in large stands of intact old-growth redwood forest in low elevation or alluvial areas from fire suppression because large damaging fires in these areas are rare (NPS 1994), and the need for fire suppression in such areas is not expected. However, damaging fires in upland redwood forests would be possible, and both the fire and suppression would have at least short-term adverse impacts on owls and murrelets.

Fires might create patches of bare mineral soil, especially in prairies or grasslands. Until bare ground revegetates, patches would be susceptible to erosion from heavy rains, resulting in sediment being transported into stream channels. Catastrophic fires generally occur in September and October and may be closely followed by heavy rains; this increases the chance of erosion. Sediment delivered into stream channels would adversely impact coho salmon and other anadromous fish. The closer the fire is to the stream, the greater the potential impact on fish from erosion. Wildfires in areas where fires have been suppressed for many years are usually more intense than fires that begin with prescribed fires. The degree of adverse impact on fish would be directly proportional to the intensity of the fire. More intense fires are more likely to create patches of bare mineral soil that are more susceptible to erosion than patches where some vegetation remains. Fire lines dug to prevent the spread of fire past a certain point would contain some of the eroded sediment. Fire managers consider the potential for erosion following a burn and incorporate methods to control erosion into their site-specific fire management plans.

Impacts Related to Visitor Use

Based on past trends, the numbers of visitors coming to the parks will continue to increase. Disturbance to northern spotted owls, marbled murrelets, peregrine falcons, and bald eagles would increase in direct proportion to increased use of the forest, coastal bluff, and stream habitats used by these species, and to snowy plover habitat on sandy beaches. Area closures would be implemented where necessary to protect threatened or endangered species nest sites from unnecessary disturbance by human activities. The proposed primitive zones would provide greater security from human disturbance for these species. Because the primitive zones would contain only existing trails, with no other facilities or new trails allowed, the primitive zones would serve as refuges for marbled murrelets and northern spotted owls.

Sportfishing for coho salmon and steelhead would be managed under regulations established by the National Marine Fisheries Service and the California Department of Fish and Game. To date there is no evidence that recreational fishing in RNSP streams constitutes a significant adverse impact on populations of coho salmon and steelhead (Dave McLeod, Fishery Biologist, California Department of Fish and Game, pers. comm., 5/27/97), but no specific studies have been done on what the impacts are.

Ongoing stocking of hatchery rainbow trout at Lagoon Creek under an agreement between the national park and the California Department of Fish and Game's Wildlife Conservation Board would be anticipated to have no short- or long-term adverse impacts on endemic populations of rainbow and steelhead. There is no connection of Lagoon Creek to other park streams. Poor survival of hatchery-raised fish under natural conditions would probably prevent the establishment of hatchery fish in park streams should hatchery-raised fish escape or be transported by people.

Campgrounds and camping along or near Redwood, Prairie, and Mill Creeks and the main stem of the Smith River at Jedediah Smith Redwoods State Park would have a minor indirect adverse impact on individual coho salmon and other anadromous fish because such streams invite recreational fishing. No long-term adverse impacts on the populations of either species would be anticipated from recreational fishing under sportfishing regulations expected to be developed by the California Department of Fish and Game.

Impacts from Education and Interpretation

Interpretive and educational programs about listed threatened and endangered species would indirectly benefit these species through increasing visitor understanding of what an endangered species is and by providing information about specific animals or plants or explaining why certain areas might be closed to protect species. Species such as marbled murrelets and northern spotted owls would benefit if visitors understood

why they should not feed corvids that prey on murrelet and owl eggs or nestlings and why quiet is important for nesting birds.

Impacts from Trail Use and Maintenance Activities

Facilities for visitors and RNSP administration require maintenance. The maintenance of trails, roads, and other facilities in dense vegetation is generally much faster with power tools than hand tools. When power tools are used, the noise is more intense but of shorter duration than when hand tools are used.

Also, it is suspected that ravens and other predators of murrelet and owl nestlings follow humans — visitors and maintenance crews — into the forest in hopes of eating food scraps. The longer that visitors use the trails or maintenance workers stay at a job site, the greater the potential for corvids to find murrelet and owl nest sites and prey on the nestlings (Ralph et al. 1995a) because there is evidence that the interior of a forest is better nesting murrelet habitat than the forest edges.

Potential impacts on northern spotted owls, marbled murrelets, and marbled murrelet critical habitat would occur from continuing to remove trees that have been determined to pose a threat to human safety or property in the three state park campgrounds. Hazard tree removal would have a localized and minor adverse impact on marbled murrelet critical habitat if an identified hazard tree that exhibits characteristics favored for nesting is removed. However, the ongoing noise and disturbance of the campers in campgrounds reduces the suitability for nesting. Trees are closely inspected by the state park resource ecologist accompanied by a U.S. Fish and Wildlife Service biologist for the presence of murrelet or owl nests as part of the hazard tree assessment process. No nest trees have ever been located in the three state park campgrounds in old-growth forests. And, the number of trees removed as hazard trees is very small compared to the number of trees available in quieter, less disturbed areas of the parks.

The total acreages of RNSP proposed and existing facilities and development (about 592 acres), excluding roads and trails within potential habitat for peregrine falcons, bald eagles, brown pelicans, snowy plovers, northern spotted owls, and marbled murrelets, and the total acreages of potential or suitable habitat within 0.25 mile of development appear in table 23. Specific acreages are listed in appendix L. RNSP staff are conducting formal consultations under section 7 of the Endangered Species Act with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the effects of maintenance activities on listed species and designated critical habitat. A biological assessment prepared by RNSP staff describes the maintenance work needed, the location of the work, and the anticipated schedule. Suitable nesting, foraging, and roosting habitat for all listed bird species is described in the assessment submitted to the U.S. Fish and Wildlife Service. The acreage of habitat affected is taken from that report. Approximate (\approx) acreage was calculated from GIS mapping (see appendix M). Acreages of designated critical habitat in state parks are included for marbled murrelets.

Conclusion

Long-term benefits for northern spotted owls, marbled murrelets and coho salmon and other anadromous fish inhabiting the forests and streams of the Redwood Creek basin would be anticipated from restoring old-growth forests and streams after second-growth forests were returned to old-growth conditions and watersheds are restored. A major benefit for fish that spawn in tributaries of Redwood Creek would be anticipated in those tributaries where watersheds were restored. Less benefit would be anticipated for fish that spawn in the main stem of Redwood Creek. Major benefits to fish from watershed restoration would be expected over the next few decades. A major benefit for owls and murrelets would be anticipated from reducing forest fragmentation over the next 200 years.

TABLE 23: ACREAGES OF SUITABLE HABITAT FOR THREATENED AND ENDANGERED BIRD SPECIES

Species	Total acres of suitable habitat within the parks	Acres of development (excluding roads and trails) within suitable habitat	Acres of development within critical habitat	Acres of suitable habitat within 0.25 mile of any development	Acres of critical habitat within 0.25 mile of facilities
northern spotted owl	≈ 55,000	≈ 192	0	≈ 3,450	0
marbled murrelet	≈ 43,000	≈ 121	≈ 120	≈ 2,260	≈ 1,500
bald eagle	≈ 12,910	≈ 281	0	≈ 2,690	0
peregrine falcon	≈ 1,910	≈ 55	0	≈ 345	0
western snowy plover	≈ 1,050	≈ 42	0	≈ 200	0
brown pelican	≈ 1,660	≈ 55	0	≈ 355	0

NOTE: Acreages of developed areas in the parks included in geographic information system (GIS) analyses total 592.19 acres. The acreages are calculated from the best available mapped data and are subject to map error.

Adverse impacts on coho salmon and other anadromous fish in the Redwood Creek basin from increases in turbidity of water in the first rainy season following watershed restoration activities would be anticipated to be minor and short-term.

Potential adverse impacts on northern spotted owls and marbled murrelets from human noise and disturbance would be minimized by restricting watershed restoration and vegetation management activities and construction and maintenance of facilities to nonbreeding seasons.

There would be minor impacts on northern spotted owls, primarily in the Redwood Creek basin, from removal of trees 40 years of age or greater for watershed and prairie restoration.

Minor adverse impacts on owls and murrelets are anticipated from occasional smoke from prescribed fires that might drift into old-growth forest habitat, and from construction, maintenance, and visitor use of trails because human presence might attract nest predators. Areas of old-growth forest designated as primitive zones

and without trails would provide blocks of undisturbed habitat for owls and murrelets. Prescribed burns in old-growth habitat are anticipated to have minor effects on owls and murrelets because burns would be planned to remove only undergrowth and would be conducted outside the breeding seasons for the birds.

Cumulative Impacts on Threatened and Endangered Species

Endangered species and their habitats would be affected by resource management programs including watershed restoration and vegetation management; by day-to-day RNSP operations such as maintenance; by recreational activities and visitor use of the parks; and by the development and use of facilities including roads, trails, and campgrounds. These activities would be managed to avoid or minimize potential adverse impacts on listed or proposed threatened and endangered species to the greatest extent possible.

Cumulative Impacts on Northern Spotted Owls and Marbled Murrelets. The primary references for marbled murrelets for this section are *Ecology and Conservation of the Marbled Murrelet* (Ralph et al. 1997; the "Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon and California" (USFWS 1997); and the *Federal Register* notice designating critical habitat (*Federal Register*, May 24, 1996, vol. 61, no. 102). The primary references for northern spotted owls are *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* (the FEMAT report, Forest Ecosystem Management Assessment Team 1993), and the *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl and the Record of Decision* (USFS and BLM 1994a).

The primary factors that create adverse impacts on northern spotted owls and marbled murrelets are loss of habitat and disturbance of breeding behaviors, which have resulted in reduced reproductive success (i.e., fledged young).

The marbled murrelets that inhabit Redwood National and State Parks have been included in a geographic zone that extends from Coos Bay, Oregon, to Cape Mendocino, California. Murrelets in this zone have been adversely affected, primarily by the direct reduction of suitable nesting habitat and the fragmentation of remaining habitat from timber harvest. Other human activities that have contributed to a decline of marbled murrelets throughout their range and that may continue to adversely affect murrelet populations include the reduction and fragmentation of suitable nesting habitat for residential and commercial development and agricultural, transportation, and recreational purposes; adverse impacts on marine foraging habitat and food supply; and direct mortality from human activities such as oils spills and gillnet fisheries. Murrelets may also be affected by factors such as ocean conditions, weather conditions that affect food production in the

ocean, or catastrophic events such as fires or windstorms.

Cumulative impacts on northern spotted owls throughout their range include adverse impacts from timber harvest and resulting habitat fragmentation; general development and resulting habitat fragmentation; and direct mortality through unauthorized take, including harassment and killing. Northern spotted owls are also subject to predation; catastrophic events such as fire and windstorms; and crossbreeding with barred owls. The relative degree of impact for these factors in and around Redwood National and State Parks is unknown, except that timber harvest has had the greatest single impact because of the amount of suitable habitat destroyed.

The primary adverse impacts on northern spotted owls and marbled murrelets in the vicinity of the parks are the loss of nesting habitat and the fragmentation of remaining habitat into isolated patches because of timber harvest, which breaks blocks of contiguous forest into smaller fragments surrounded by blocks of unsuitable habitat. Most suitable nesting habitat has been lost since the mid-1940s.

Of all Pacific Northwest bird species, the marbled murrelet is considered to be one of the most sensitive to forest fragmentation. The fragmentation of available nesting habitat is believed to increase the vulnerability of nesting murrelets to predation. Landscape fragmentation on private lands, which is greater than on RNSP lands, results in proportionally greater adverse impacts on the murrelet population than the fragmentation of RNSP lands because there are larger contiguous old-growth stands remaining in the parks and because the last timber harvest in what is now the national park occurred in 1978. The fragmentation of habitat due to previous timber harvest in the Redwood Creek basin is declining as the forest regrows.

The continued harvest of timber in old-growth forests on private lands adjacent to Redwood National and State Parks has reduced the available suitable owl and murrelet habitat in the

region to a greater extent than minor alterations and disturbance on RNSP lands. The largest amount of suitable nesting habitat for murrelets within the region occurs primarily in Redwood National and State Parks and other state parks in Humboldt County, whereas there is suitable owl nesting habitat available outside the parks. The potential adverse impacts of RNSP actions on owls would be expected to be less than the impacts on murrelets because owls have a wider range and less restrictive nesting requirements within the region.

Continued timber harvest on private lands would have adverse impacts on northern spotted owls and marbled murrelets. Marbled murrelet critical habitat would not be destroyed or adversely modified by timber harvest activities conducted on U.S. Forest Service and Bureau of Land Management land according to the standards and guidelines for late-successional reserves, as described in the 1994 "Record of Decision" for the *Northwest Forest Plan*. Activities in these areas would be limited to the manipulation of young forest stands that are not currently marbled murrelet nesting habitat. These forest management activities would be conducted in a manner that would not slow the development of these areas into future nesting habitat, and should speed the development of some characteristics of older forest.

Northern spotted owl habitat would be protected, and it would be unlikely that their continued decline throughout their range would occur if timber harvest activities were conducted according to the standards and guidelines for late-successional reserves, as described in the "Record of Decision" for the *Northwest Forest Plan*. Management direction and land allocations described in these standards and guidelines constitute the contribution of public lands managed by the Bureau of Land Management and the U.S. Forest Service to the recovery of the northern spotted owl. In combination with RNSP staff actions to protect northern spotted owls and avoid or minimize adverse impacts on the owls, there would be moderate long-term cumulative benefits to northern spotted owls.

About 3,887,800 acres have been designated as critical habitat for marbled murrelets throughout their range, outside of Alaska and Canada. In northern California, this includes (1) 477,300 acres of federal lands, none of which are congressionally designated wilderness areas, national parks, or national wildlife refuges; (2) 175,500 acres of state lands, including the three state parks within Redwood National and State Parks, and (3) 40,400 acres of private lands. There is a major cumulative benefit for marbled murrelets from protecting critical habitat throughout their range.

Thus, continuing timber harvest of stands occupied by marbled murrelets outside the parks would reduce the overall population of marbled murrelets. This would be a moderate to major short-term direct adverse impact on individual birds and a moderate direct adverse impact on the population due to the loss of nesting habitat. The restoration of second-growth forest through thinning in the parks as mitigation for offsite timber harvest would increase available nesting habitat in the region, but it is not known whether murrelet populations would remain stable during the time required for the second-growth forests that have been thinned to develop into suitable nesting habitat.

Vegetation management within the parks would be expected to result in major long-term benefits for marbled murrelets and northern spotted owls from reducing forest fragmentation through the management of second-growth forests and from restoring fire as a natural ecosystem process. A major direct long-term benefit for northern spotted owls and marbled murrelets would be expected from the management of second-growth forests so that these managed forests more closely mimic nesting characteristics found in old-growth forest habitat. A greater benefit would be anticipated for the murrelet populations than for owls because murrelets are more dependent for nesting on old-growth forests and have more restrictive nesting requirements than owls.

Implementing a fire management program that reduces the risk of large damaging fires that would destroy old-growth habitat would be expected to have a minor indirect long-term positive benefit for marbled murrelets and northern spotted owls. There would be a moderate, positive, long-term impact from reintroducing fire into the ecosystem.

There could be a minor indirect positive benefit for marbled murrelets and northern spotted owls from a more aggressive visitor education program, which might reduce the purposeful or accidental feeding of corvids at campgrounds, trailheads, and other development areas.

Cumulative Impacts on Threatened and Endangered Fish. The primary references for this section are the *Federal Register* notices for rules for determining or proposing endangered or threatened status for coho salmon and other anadromous fish.

Habitat modification and destruction, overfishing, and adverse weather conditions in the region have resulted in a significant cumulative adverse impact on coho salmon and other anadromous fish. Habitat destruction throughout its range has resulted in a significant cumulative adverse impact on the tidewater goby.

Activities and actions that have combined to reduce the populations of coho salmon and other anadromous fish are (1) recreational fishing in rivers and offshore, (2) commercial fishing offshore, (3) competition with hatchery fish, (4) weather that has produced poor foraging, survival, or spawning conditions in streams and the ocean, (5) logging practices that have substantially reduced quality and quantity of spawning habitat, (6) sea lions that gather at river mouths to eat fish moving between ocean and river, (7) dams for flood control, water storage, and hydroelectric power generation that have altered habitat, impeded passage to upstream spawning grounds, and sometimes directly killed fish, and (8) other activities that have reduced or degraded habitat including urbanization, mining, and agriculture.

The loss of a stream habitat is widely acknowledged as the single biggest cause of declines of anadromous salmonids in the Pacific Northwest and of coho salmon in particular. Most of the habitat loss has been the result of watershed disturbances associated with urbanization, logging, agriculture, mining, and other human activities. Such activities are associated with the severe loss of the habitat complexity that is characteristic of productive salmonid streams, especially the lack of large woody debris and the sedimentation of spawning and rearing areas. Habitat damage was attributed to erosion and the slumping of hillsides, which was exacerbated by the construction of logging roads and skid trails on steep slopes and by the removal of vegetative groundcover. Watershed disturbances upstream of the parks and large flood events in the Redwood Creek watershed have contributed to the degradation of both coho salmon and steelhead spawning and rearing habitat.

The decline of coho salmon in California has probably been exacerbated by natural climatic events. The droughts of 1976–77 and 1986–92 have made conditions worse in many streams. On the other hand, heavy precipitation produces stream scouring that can destroy both redds (spawning grounds) and stream habitat. The effects of the 1964 floods on north coast streams can still be seen in the streambeds and in the reduced amount of high-quality habitat. Natural recovery has been occurring very slowly in some drainages. El Niño ocean conditions can reduce survival and growth of coho salmon. Coho salmon in California undoubtedly survived catastrophic natural events in the distant past, but they were not simultaneously confronted with widespread human-related degradation of their spawning streams.

Some tributaries of Redwood Creek are impassable for juvenile salmonids during summer low flows because the water does not flow on the surface of the stream channel. This subsurface flow of water is attributed to filling in of the channel because excess sediment has washed into the channel.

Populations of the tidewater goby throughout its range have been reduced through habitat loss from dredging and filling of coastal salt marshes, lagoons, and estuaries. The dredging and filling are due to (1) residential, recreational, and industrial development, (2) agriculture (3) flood control and other channelization projects (4) water diversions and overuse of water supplies, (5) road building; predation from introduced fishes, and (6) adverse weather conditions that produce drought and flooding. In Redwood National and State Parks, adverse impacts on the tidewater goby have resulted from (1) the construction of flood control levees at the Redwood Creek estuary, (2) the sedimentation in the estuary from marine deposits, (3) the dredging and filling of the estuary for residential and agricultural development, (4) alterations to the estuary habitat from drought and flooding, and (5) the controlled and uncontrolled draining of the estuary to protect private and government property. These actions have had a major cumulative adverse effect on tidewater gobies in the Redwood Creek estuary.

Shortening the time available for restoration in a given year lengthens the time required to accomplish watershed restoration within the parks. Lengthening the restoration process over many years increases the chance of a major storm that could result in widespread major failures of abandoned logging roads, with a corresponding major increase in sediment delivered into the parks' streams. This would be a moderate to major adverse impact on coho salmon and other anadromous fish in tributaries of Redwood Creek and other fish-bearing streams within the parks downslope of timber harvest areas over both the short and long term, and a moderate long-term adverse impact on tidewater goby habitat in the Redwood Creek estuary.

IMPACTS ON MARINE RESOURCES

Actions that are related to marine resources would result in no direct impacts on air quality, cultural resources, visual quality, visitor access

and circulation, quality of visitor experience, visitor use, regional economy, population and housing, public and commercial services, land use, or American Indian Tribes.

Completing an inventory of marine resources would cause no adverse impacts on soils. Any inventories done adjacent to sandy shoreline might disturb western snowy plovers if plovers were present. There would be minor indirect benefits for wetlands (sandy shoreline, rocky intertidal zones) from increased understanding of marine plant and wildlife values. There would be minor long-term benefits to the marine ecosystem from increased knowledge of RNSP resources.

There would be long-term indirect minor benefit from increased protection of marine resources that might result from activities that involved cooperation with other agencies. There might be temporary minor adverse effects on marbled murrelets at sea if at-sea surveys disturb foraging birds. There would be minor long-term benefits to murrelets from an increased understanding of the population dynamics of the birds off the coast.

IMPACTS ON CULTURAL RESOURCES

The emphasis in actions involving both cultural and natural resources would be weighted toward the protection and preservation of the resource(s) that would be most easily damaged. Thus, conflicts in managing cultural and natural resources could result in impacts on cultural resources if, in the resolution of such conflicts, it was determined that the protection and preservation of the natural resource(s) superseded that of the cultural resource(s). Chapter 5 page 5 of the NPS *Management Policies* (1988) permits the planning process to make this decision:

Achievement of other park purposes may sometimes conflict with and outweigh the value of cultural resource preservation. The planning process will be the vehicle

for weighting conflicting objectives and deciding that a cultural resource should not be preserved. Following such a decision, significant resource data and materials will be retrieved. The resource will then be permitted to deteriorate naturally, unless its destruction or direct removal is necessary for public safety or to eliminate an unacceptable intrusion.

Impacts on cultural resources resulting from such decisions, however, would be mitigated to the fullest extent possible.

The necessity of monitoring construction activities to ensure the protection of archeological resources would be determined on a case-by-case basis by the RNSP cultural resource specialist. If previously undiscovered archeological resources were unearthed during construction activities, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed, if necessary. If construction impacts on archeological sites could not be avoided, the recommended strategy of site testing and data recovery would be implemented after consulting with the California State Historic Preservation Office to ensure that the informational significance of the sites would be preserved. The effect of such impacts on archeological sites would be considered adverse due to the data recovery, as stipulated by the *Protection of Historic Properties* (36 CFR Part 800.5, "Assessment of Adverse Effects").

If Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed. The disposition of human remains identified as being not of Native American origin would be handled after consultation with the descendants of the dead and in accordance with applicable federal and/or state laws, policies, and guidelines.

Radar Station B-71 and the segment of the old Redwood Highway north of the Klamath River, which are listed on the National Register of Historic Places, would continue to be protected and preserved in their present forms. None of the alternatives would introduce any actions that would adversely compromise the integrity of these resources.

To appropriately preserve and protect the RNSP cultural resources that are either listed on or eligible for inclusion on the National Register of Historic Places, all preservation and rehabilitation efforts, as well as daily, cyclical, and seasonal maintenance, would be undertaken in accordance with the federal and state guidelines and policies.

Adaptively rehabilitating the historic Prairie Creek Fish Hatchery would result in the loss of some historic fabric. The preparation of a historic structure report, which documents the history and changes through time of buildings and structures, would precede the adaptive rehabilitation of the hatchery. In addition, sensitivity to the character-defining features of the interior would guide the rehabilitation; all work necessary to rehabilitate the fish hatchery would be physically and visually compatible (new material would match the historic composition, design, color, and texture) but would also be identifiable upon close inspection. All materials removed during rehabilitation of the building would be evaluated to determine their value to the parks' museum collections and/or for their comparative use in future preservation work at the site.

The use of historic buildings for interpretation or visitor services and concessions would also result in increased deterioration of such resources through wear and tear and vandalism. However, the parks' interpretive and educational programs would instill an understanding and appreciation of the value of the parks' resources and how they are preserved, as well as provide an understanding of how to enjoy experience such resources without inadvertently damaging them. In addition, determining and monitoring the carrying capacity of the resources could

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result in the imposition of visitation levels or constraints that would contribute to the stability or integrity of the resources without unduly restricting their use or interpretation.

The Prairie Creek Fish Hatchery could be a candidate for the historic property leasing program. If a historic property lease allowed the lessee to maintain, repair, rehabilitate, or build upon the property, the lease would require all work to be done in accordance with applicable NPS policies, guidelines, and standards.

Cultural resources treated as discovery sites would be more susceptible both to wear and tear and vandalism, due to unsupervised visitation of the sites. However, enhancing the interpretive/educational components of the parks' cultural resource management program would increase public sensitivity to the importance of the resources and potentially limit such degradation.

Making historic buildings accessible to the mobility impaired, to comply with the Architectural Barriers Act of 1968 and the Rehabilitation Act of 1973, could result in the loss of historic fabric or the introduction of new visual and nonhistoric elements. For example, the doorways of buildings could require widening and ramps, or wheelchair lifts could be added to the exterior of buildings. Redwood National and State Parks would strive, however, to develop design solutions to accessibility requirements that minimize impacts on cultural resources.

If landform restoration, to restore watersheds or prairies, is slated to occur within any of the parks' potential cultural landscapes, the preparation of cultural landscape inventories or reports would precede the restoration. The arrangement and interrelationship of the landscape's character-defining features, as they existed during the period of significance, would be important to consider before the restoration and would provide guidance for the future management, maintenance, and interpretation of the landscape.

Although significant cultural landscapes would be protected and preserved, increased visitor use,

resulting from enhanced interpretation of the parks' resources or the expansion or construction of parking areas, trailheads and trails, and picnicking and campsites, could result in the overuse and degradation of such contributing landscape features as roads and trails, buildings and structures, or fence rows and orchard remnants. However, the parks' interpretive and educational programs would also increase visitor appreciation of the resources and how they are preserved and managed, as well as provide an understanding of how to experience such resources without inadvertently damaging them.

The removal of the CDPR facilities from Elk Prairie, which are nonhistoric and noncontributing features, would improve the integrity of this potential cultural landscape by returning the landscape to more of a semblance of its historic appearance.

Cultural resources in the Bald Hills would benefit from comprehensive planning because actions and priorities would be established to clarify management goals, reduce conflict between natural and cultural resources management, and accommodate interpretation, visitor use, and traditional uses with minimum damage to both cultural and natural resources. Greater visitor understanding and appreciation of the resources associated with the Bald Hills would contribute to their protection and preservation.

None of the actions associated with the implementation of any of the alternatives would impact submerged resources.

Actions undertaken to minimize erosion along historic roads and trails would be implemented in a manner that would preserve the integrity of the resources.

Visual, audible, and atmospheric intrusions would occur in the vicinity of all construction activities. Such impacts, however, would be temporary and minor.

Including cultural resource management in the curriculum of the outdoor schools would

increase students' knowledge, appreciation, and support of the parks' cultural resources.

Partnership efforts with American Indian tribes and preservation groups would enhance both the management and interpretation of cultural resources.

The acquisition of lands or interests in lands by Redwood National and State Parks would benefit cultural resources by extending the protection of either federal or state preservation laws.

RNSP staff would work with neighboring landowners and jurisdictions to ensure that adjacent land management practices would not impair the parks' cultural resources, viewsheds, or distant vistas.

Actions occurring outside of RNSP boundaries are not subject to compliance with federal preservation laws, unless such actions are authorized, funded, or permitted by a federal agency. As a result, landform restoration or the construction of a nonfederally funded visitor center could impact cultural resources on private lands. RNSP staff, however, would provide technical assistance, as requested, to help mitigate impacts on cultural resources that are outside of the parks' boundaries.

Conclusion

The protection and preservation, management, and interpretation of the parks' cultural resources would be enhanced and, with appropriate mitigation, there would be no adverse impacts on the resources.

Cumulative Impacts

Cumulative impacts upon cultural resources would result from damage from unsupervised or increased visitor use and the loss of historic fabric associated with the adaptive rehabilitation of the Prairie Creek Fish Hatchery. It is possible that cultural resources outside the RNSP

boundaries have been destroyed or damaged in the past by nonfederal or nonstate actions. Most actions proposed in this joint plan fall under the auspices of federal preservation laws, as well as the California Environmental Quality Act, which provide legal protection for cultural resources. However, actions occurring outside of the parks' boundaries, such as landform restoration, could adversely impact cultural resources not afforded the protection of federal or state law.

IMPACTS RELATED TO RELATIONSHIPS WITH AMERICAN INDIANS

Implementing the *General Management Plan / General Plan* would reaffirm the commitment of RNSP staff to positive relationships with American Indians — not only in a government-to-government capacity, but also through partnerships that encourage American Indian participation in the management and interpretation of the parks' resources.

Ethnographic resources would be managed with an emphasis on preserving and protecting both the resources and the practices traditionally associated with them. The coordination of natural and cultural resources management programs would be enhanced, particularly scientific study of the application of traditional American Indian practices to resource management activities.

There would be increased opportunities for visitors to observe and learn about the traditional practices of American Indians, which would allow visitors to develop a greater appreciation for American Indian culture, although attention would not be drawn to the most sensitive of the parks' ethnographic resources.

Conclusion

Both relationships with American Indians and the preservation and protection of the parks'

ethnographic resources would be enhanced. With appropriate mitigation, there would be no adverse impacts on the resources.

Cumulative Impacts

Cumulatively, cultural resources would benefit from the following:

- Management and interpretation of the parks' cultural resources in partnership with American Indian tribes.
- Active support of continuing traditional American Indian cultural practices.
- Increased public understanding of and sensitivity to the importance of the parks' ethnographic resources.

IMPACTS ON PUBLIC SAFETY

Severe ground shaking, landslides, and tsunamis from a large earthquake could cause widespread regional damage including cutting off roads, communication lines, electrical utilities, fuel pipelines, and water supplies; making structures collapse and tress fall; flooding coastal areas; and the loss of life in the parks and surrounding areas.

During an earthquake, a tsunami (a seismic sea wave) could arrive on the coastline within minutes of the ground shaking. There could be significant property damage and possibly the loss of life in areas that were affected by the tsunami. In addition to damage directly from the sea wave, water-driven debris such as logs, small boats, building materials, and vehicles could

contribute to the damage. The Redwood Information Center could be severely damaged, and serious injuries or loss of life could occur when a tsunami strikes the coastline. People at Freshwater Lagoon Spit and Gold Bluffs Beach would also be at significant risk. Other RNSP structures and facilities near the coast that could sustain damage from a tsunami include the Crescent City Information center/park headquarters, the Crescent Beach Education Center, and structures at Crescent Beach and Gold Bluffs Beach. The inherent seismic risk in northern California cannot be reduced, but the risk could be mitigated by appropriate siting and design criteria that would be used for all new and retrofitted facilities to protect life and reduce the potential of property damage. To minimize damage from a tsunami, warning signs would be placed along the coast, and RNSP staff and publications would warn visitors about imminent tsunami dangers through the regional tsunami warning system that is being developed.

Conclusion

Severe ground shaking, landslides and tsunamis caused by an earthquake could have major adverse impacts on humans and RNSP resources. There are no actions proposed in this joint plan that could avoid damage from an earthquake or tsunami because it is a natural, unavoidable risk in the region. To mitigate for possible damage from an earthquake, appropriate siting and design criteria would be used in all new and retrofitted structures in the parks, and RNSP staff and publications would warn visitors and inform them about the regional tsunami warning system being developed.



IMPACTS OF IMPLEMENTING ALTERNATIVE 1 — THE PROPOSED ACTION

IMPACTS ON NATURAL RESOURCES

Soils

Minor soil disturbance and subsequent erosion would occur during the construction of facilities, roads, trails, and campsites proposed in this alternative. Construction-related soil erosion impacts would be minor, but there would be more runoff and erosion associated with the construction and use of the additional facilities and trails.

This alternative would emphasize complete landform restoration along major roads and limited removal of minor roads on parklands in the lower Redwood Creek basin. About 155 miles of major roads would be removed, with an average of 9.5 miles of road removed per year over a period of 17 years. Roads that pose the greatest threat to resources would be treated first under this alternative. Erosion potential would be reduced at stream crossings and along all intervening major road segments through the restoration of landforms, soils, and hydrologic patterns. This landform restoration work would occur in a time period similar to alternatives 3 and 4 (17 years) and nearly four times faster than alternative 2 (66 years). For a summary of the methods of treatment of abandoned logging roads, see table 2; for an illustration of the density of roads in Redwood Creek basin see the Roads in the Redwood Creek Basin map.

Partial landform restoration treatments would be the same as alternatives 2 and 4, resulting in major beneficial impacts on downslope and downstream aquatic habitats, primarily in the tributaries of Redwood Creek. Over the long term, buried topsoil would be recovered and evenly distributed on the finished surface of the completely removed roads, helping to reestablish vegetation and reducing soil erosion and sedimentation in streams — a major beneficial impact. Watershed restoration treatments would also have the beneficial impact of protecting

soils and vegetation on steep slopes below the roads.

Prelogging topography would be restored along the treated major roads and would improve the visual quality of the basin as roads were removed and the area was recontoured and revegetated. However, minor roads would receive only limited, partial treatment, primarily near streams. These roads would continue to disrupt natural hillslope hydrology, and vegetation would recover more slowly because little topsoil would be returned to the surface. Acceleration of the disturbed lands restoration program with this alternative would reduce the likelihood that a large damaging storm would cause catastrophic resource degradation because the restoration treatments would occur more quickly than under current conditions (alternative 2). If a major storm occurred before completion of the restoration program, there could be localized major adverse impacts on the same resources, from untreated areas.

Road decommissioning and erosion prevention efforts would treat roads in the same time period as alternatives 3 and 4 (17 years) and much faster than alternative 2 (227 years). Where road decommissioning is undertaken, areas prone to landslides, areas showing signs of instability, and areas with potential to deliver sediment to streams would be treated and stream crossings would be returned to their original configuration. More roads could be treated in a shorter period of time than with landform restoration treatments, so erosion potential would decrease more quickly in the upper basin than on parklands where landform restoration treatments would be used. Areas with potential to deliver sediment to streams would be treated, and stream crossings would be returned to their original configuration. However, there is the possibility that road sections that were not identified as having high erosion potential and were not treated could fail after treatment was completed. This alternative would have a moderate beneficial impact on aquatic habitats and alluvial redwood groves

along the main stem of Redwood Creek upstream and within the national park.

Conclusion

The ongoing use, maintenance, and management of roads, trails, and facilities would cause minor disturbances to soils, such as soil erosion and soil compaction. There could be a minor amount of runoff and soil erosion associated with the construction of additional roads, campsites, trails, and facilities. The watershed restoration program on parklands in the lower Redwood Creek basin would have a major beneficial impact on downslope and downstream terrestrial, riparian, and aquatic habitats. Over the long term, alternative 1 would greatly improve the national park's resources through the removal of abandoned roads and the restoration of landforms, soils, vegetation, and hydrologic patterns on parklands in the lower basin. However, the ecosystem impacts associated with the minor roads, which receive only limited treatment throughout the basin, would continue. Upstream of the park, road decommissioning and erosion prevention treatments would help protect aquatic habitats and alluvial redwood groves along the main stem of Redwood Creek against the immediate erosional threats from a large storm and would have a moderate beneficial impact on these resources.

Cumulative Impacts

Over the long term (decades to centuries), watershed restoration treatments on parklands in the lower Redwood Creek basin and cooperative erosion control activities upstream of the national park would have a major beneficial cumulative impact of reducing soil erosion and sedimentation that have been adversely affecting downstream resources such as wildlife, water quality, vegetation (alluvial redwood groves, riparian vegetation, and hillslope forests and prairies), and aquatic habitats in the tributaries and main stem of Redwood Creek.

Water Quality

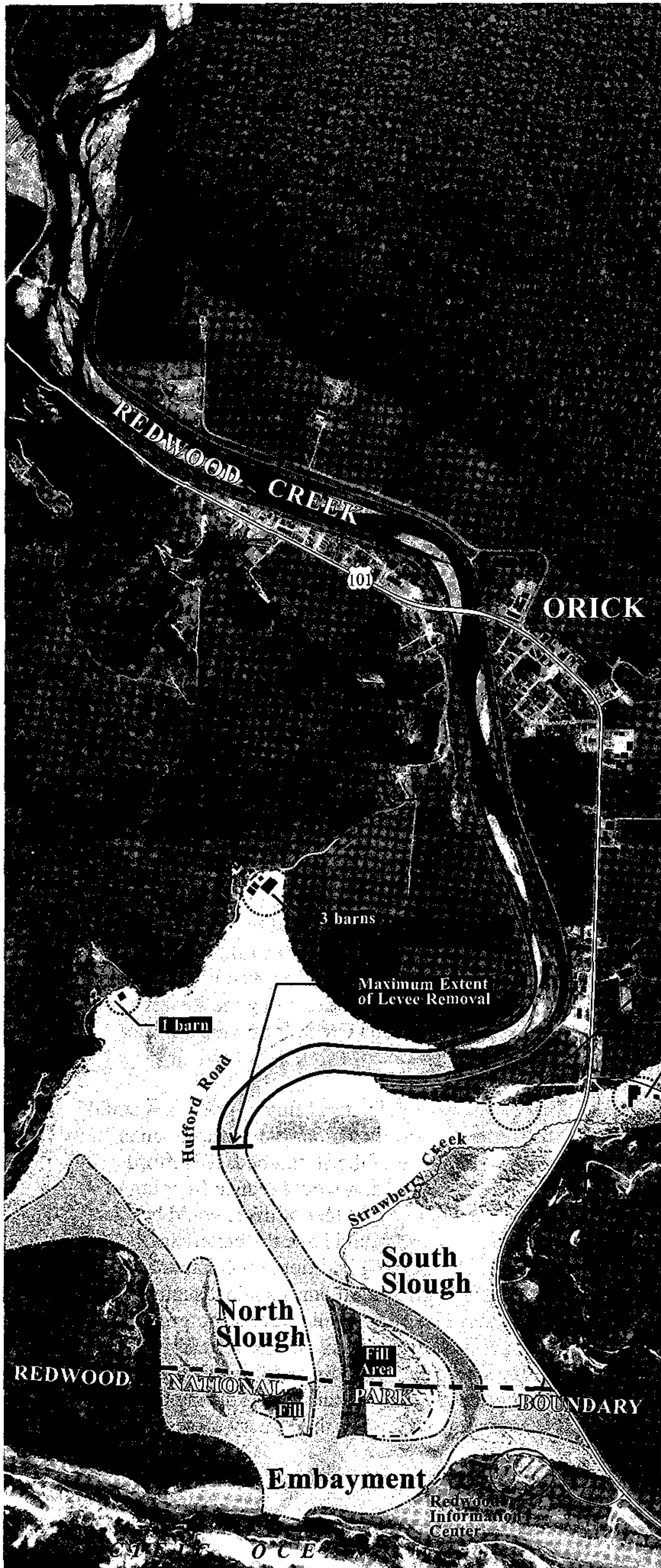
Construction activities (road improvements and the construction of facilities) could result in minor increases in suspended sediment, turbidity, and fuels in area streams. Mitigation measures would be employed to reduce runoff from construction sites, which would lessen construction-related water quality impacts.

With this alternative there are several different options that could be implemented to restore portions of the Redwood Creek estuary, including the removal of the south slough culverts or portions of the north, south, or both levees along Redwood Creek. Removing the south slough culverts would increase the one-way flushing of the entire slough and would improve its water quality. Removing 0.6 mile of the downstream portion of both levees would provide the most beneficial impacts on water quality of all of the options because natural river processes would be reestablished in the entire lower Redwood Creek. The primary benefit to water quality from removing the levees would be restoring circulation patterns that move sediment more effectively than when the creek is confined by the levees.

Restoring wetlands and riparian vegetation in the areas where the levees would be removed would improve water quality in the Redwood Creek sloughs and estuary by providing a filter for contaminants, decreasing streamside erosion, and decreasing water temperatures. Removing portions of the levees would cause increased turbidity levels over the short term.

Impacts on water resources caused by private land uses would depend on the level of cooperation between private landowners and RNSP staff and the willingness of other agencies to enforce their water resources protection programs. The reduction of sediment sources would improve water quality to a much greater degree than the removal of agricultural sources of pollution (fertilizer, animal waste) because the latter sources produce only minor decreases in water quality compared to sediment.

ON MICROFILM



ORICK

REDWOOD CREEK

101

3 barns

Maximum Extent of Levee Removal

1 barn

Hufford Road

Strawberry Creek

South Slough

North Slough

Fill Area

REDWOOD NATIONAL PARK

BOUNDARY

Embayment

Redwood Information Center

1 house
1 garage
1 trailer
1 equipment building

2 houses
2 trailers

To South Operations Center

Legend

- Existing 100-year Floodplain
- Expanded 100-year Floodplain (following levee removal)

North no scale

EXPANDED FLOODPLAIN/LEVEE REMOVAL

Redwood National & State Parks • California
NPS • DSC • Sept 99 • 167 • 20088A

Conclusion

Construction-related water quality impacts would be moderate without mitigation but would be reduced to minor impacts by employing mitigation measures to reduce runoff and contamination of streams. Removing portions of the levees would cause increased turbidity levels over the short term. When streamside vegetation becomes reestablished, it would have a local, major, long-term beneficial impact of trapping and filtering contaminants originating from grazing and ranching activities, decreasing water temperatures, and decreasing streamside erosion. The amount of benefit for water quality would depend on how much of the levees was removed. As watershed restoration programs were completed, there would be a moderate beneficial cumulative impact on water quality in the tributaries and main stem of lowermost Redwood Creek, the lower Redwood Creek valley, and the estuary.

Cumulative Impacts

There would be minor, adverse, short-term cumulative impacts on water quality from the introduction of sediment and fuels during the construction of additional RNSP facilities. Watershed restoration in Redwood Creek basin would have a moderate beneficial impact, and partial levee removal in the lower Redwood Creek valley would have a major, beneficial, long-term cumulative impact on the water quality in the tributaries and main stem of lowermost Redwood Creek and the estuary.

Floodplains

Land acquisition, conservation/flood easements, partial levee removal, levee restructuring, and the construction of dikes are options that would be considered for restoring the estuary while still retaining current land uses in the lower Redwood Creek valley. Up to 130 acres of land could be purchased from willing sellers in the lower Redwood Creek valley (see Expanded Floodplain/Levee Removal map) to assist in

estuary restoration efforts. Flood easements rather than land purchases could also be acquired from willing sellers on the 95 acres subject to flooding. Restoration actions in the lower valley could include one or more of the following options: (1) removing the lower 0.6-mile section of both north and south levees within the national park boundary, (2) removing a portion of the south levee within the national park boundary, (3) removing a portion of the north levee within the national park boundary, (4) removing the south slough culverts and partial levee removal within the national park boundary, and (5) only removing the south slough culverts. The extent of restoration of the estuary (hydrologic processes, vegetation, wetlands, and wildlife and aquatic habitat) would depend on land acquisition and/or easements and which partial levee removal scenario was selected.

If the lower 0.6 mile of the federal flood control levees were removed on Redwood Creek, the 100-year floodplain would increase by up to 332 acres of both private and federal land (see table 24 below for a comparison of partial levee removal options). Twelve structures (three houses and eight barns, trailers, and storage buildings) would be in the restored 100-year floodplain. Any potential impacts on these structures would be mitigated before removing the levees. Retaining the levees at their current length and configuration would continue to protect ranching activities along the lowest portion of Redwood Creek from major winter floods.

The restoration of natural fluvial processes could result in increased erosion of the streambanks and aggradation of the streambed. If Hufford Road was elevated, it would reduce flooding of the road. Up to 5,600 feet of dikes could be constructed and would have the beneficial impact of providing additional fish habitat and protecting agricultural lands against summer flooding. The dikes would have a footprint of 3.3 acres and would have the beneficial impact of retaining and providing additional fish habitat and protecting agricultural lands during the summer and fall when the estuary closes and the

TABLE 24: SUMMARY OF PROPOSED MANAGEMENT OPTIONS IN THE LOWER ORICK VALLEY AND THEIR IMPACTS ON RIVER MORPHOLOGY, FLOODPLAINS, AND THE ESTUARY UNDER ALTERNATIVE 1

Management Options	Impacts
Land Acquisition Options	
Acquire interests in lands in lower Redwood Creek valley.	Landowners would be compensated for up to 130 acres of agricultural land removed from production.
Purchase flood easements in lower Redwood Creek valley.	About 95 acres of private land would be subjected to periodic (summertime) flooding; during flooding, grazing could not occur; major winter flooding would threaten Redwood Information Center.
Options for Levee Modification	
Remove the lower 0.6 mile of federal flood control levees on Redwood Creek up to the first upstream bend in the river OR	Would help restore natural hydrologic and biological processes in the estuary, improve the fertility of floodplain soils and summer water quality and aquatic habitat, and eliminate the need for periodic dredging of the sloughs. Would also increase the size of 100-year floodplain by 332 acres and the extent of wetlands as well as estuary streambank erosion and river migration, water circulation in the north slough during high flows, and the extent of winter flooding. During flooding, grazing could not occur. Up to 12 structures could periodically be flooded on the expanded 100-year floodplain west of Orick.
Remove south federal flood control levee up to the first upstream bend in the river (lower 0.6 mile) OR	Would help restore natural hydrologic and biological processes in the southern part of the estuary, increase the size of the 100-year floodplain by 290 acres, and allow natural river migration towards the south. Potential for increased winter flooding on the south side of Redwood Creek, erosion and aggradation of the streambed, backwater flooding upstream and outside remaining portions of the levees, and erosion of the stream channel and south slough might occur. Periodic flooding of up to eight structures could occur. During flooding, grazing could not occur.
Remove north federal flood control levee up to the first upstream bend in the river (lower 0.6 mile) OR	Would help restore natural hydrologic and biological processes in the northern part of the estuary, increase flooding on north side of Redwood Creek, increase the 100-year floodplain by 290 acres, and allow natural river migration towards the north. There would be adverse impacts of increased winter flooding on north side of Redwood Creek, aggradation of the streambed, increased potential for backwater flooding upstream and outside the remaining portions of the levees, and increased erosion of the stream channel and north slough. During flooding, grazing could not occur. Periodic flooding of up to four structures could occur.
Construct dikes and tidal gates in pastures	Water levels could increase and provide additional summer salmonid habitat and protect the pastures from summertime flooding and eliminate 1.6 acres of palustrine emergent wetlands; other wetlands could be converted to dryland pastures. Additional flood control structures would continue to adversely impact fluvial processes (i.e., river migration) in the lower Redwood Creek valley.
Additional Restoration Activities	
Continue channel manipulation to protect the Redwood Information Center.	Would interfere with hydrologic restoration but ensure that the center would not be destroyed by river migration.
Remove south slough culverts (with or without partial levee removal).	Winter high flows would not be as likely to inundate entire floodplain as with the removal of more of the levees. Would restore fish and wildlife habitat and the circulation patterns and morphology of the south slough. Would also increase the potential for backwater flooding upstream and outside of the remaining portions of the levees, erosion of stream channel and sloughs, and sedimentation in the estuary.
Dredge north and south sloughs	Would temporarily increase turbidity, improve water quality over the long term, and help temporarily reestablish historic water depths in the estuary. Aggradation and overwash would continue to occur.

ENVIRONMENTAL CONSEQUENCES

Management Options	Impacts
Elevate Hufford Road	Would eliminate .09 acre of wetland/floodplain, and ensure access for landowners during periods of flooding.
Restore riparian vegetation	Would decrease stream temperatures and help filter contaminants from agricultural runoff.
Watershed restoration activities (erosion prevention everywhere, with complete landform restoration at selected locations)	Would decrease sediment inputs from upstream and would, over time, reduce downstream streambed aggradation and channel widening; would also reduce streambank erosion and increase the size of deepwater pools.

embayment water level rises. Diking would further artificially modify the lower valley and would require mitigation for the loss of wetlands and a portion of the floodplain.

Ongoing watershed restoration activities would reduce the amount of sediment entering Redwood Creek and its tributaries and would assist the recovery of downstream plant and animal communities, stream morphology, and hydrologic and biological processes. Siltation and aggradation, increased bank erosion, and channel widening in Redwood Creek basin streams would continue to occur and would lessen as roads, road benches, and stream crossings were restored in selected areas. The erosion potential at stream crossings would be eliminated upon the completion of the watershed restoration program; however, the downstream beneficial effects of these treatments might take decades to centuries to be fully realized (D. Short, RNSP geologist, pers. comm., 1997).

Conclusion

Depending on landowner cooperation and which partial levee removal scenario was selected, there would be varying beneficial and adverse impacts on the lower Redwood Creek floodplain and estuary. Acquiring interests in lands and removing portions of the levees would help restore natural processes and conditions in the river and estuary and would also improve aquatic habitat and water quality and increase the size and extent of the wetlands and floodplain.

Dredging the sloughs would temporarily increase turbidity in the estuary but would help reestablish historic water depths in the estuary, a beneficial impact for fisheries and water quality. Elevating Hufford Road would ensure landowner access during periods of flooding. As watershed restoration was completed in Redwood Creek basin, adverse impacts on natural resources in the lower Redwood Creek valley would diminish over the long term (decades to centuries).

Cumulative Impacts.

Removing a portion of the levees in the lower Redwood Creek valley, in conjunction with upstream watershed restoration activities, would have a major, cumulative, long-term beneficial impact on the physical and biological functioning of lower Redwood Creek and its estuary.

Wetlands

Impacts from Watershed Restoration

This alternative would have long-term benefits on riverine and palustrine wetlands in all drainages where landforms were restored and roads removed or treated to reduce erosion. Under both methods of treatment, primary hydrologic patterns would be restored. The greatest benefit for these wetlands would occur in those areas in which the landforms are completely restored to original conditions. Long-term benefits to wetlands downslope of areas where drainage patterns continue to be altered by the presence of

logging roads would not be as great, because the failure of some road segments is inevitable.

In those watersheds where some road segments are not completely removed, the possibility for landslides to occur from some untreated road sections would continue to threaten downstream and downslope riverine and palustrine wetlands. The potential for adverse effects from landslides that could alter drainage patterns and destroy vegetation and wildlife in and adjacent to stream channels would be reduced, a long-term beneficial impact.

Impacts of Estuary Restoration

Where the levees in the Redwood Creek estuary were removed and no longer confined the stream channel, the creek would meander within the floodplain, creating wetlands in the meanders and resulting in a net increase of wetlands in the area. The degree of benefit for wetlands under this alternative would depend primarily on the length of levee that is removed. Partial removal (0.6 mile) of the levee in the lower Redwood Creek valley would increase the overall area of wetland because water confined within the levees would spread out over a larger area near the mouth of the creek. The area of wetland would be estimated to increase by about 200 acres. Based on the location of the new wetlands in relation to the current wetland types, the amount of estuarine wetlands would be expected to increase by about 25 acres and palustrine wetlands by about 175 acres. The associated functions and values of these wetlands include flood attenuation, wildlife and fish habitat, aesthetic and recreational benefits, and water quality improvements.

High flows during the winter would inundate more of the original floodplain if portions of the levees were removed. Periods of inundation that now vary from irregularly flooded at the south slough to irregularly exposed for the north slough would be expected to increase so that more area at the mouth of the creek would be flooded for longer periods each year, depending

on the annual precipitation and when flooding occurs.

Elevating Hufford Road to provide access for property owners would result in a loss of 0.09 acres of wetlands when the roadbase was widened.

Acquiring flood easements would increase the extent of seasonal wetlands by allowing floodwaters to spread out over agricultural lands. However, native wetland vegetation would not be restored on private agricultural land. Up to 5,600 feet of dikes could also be constructed to protect the north and south pastures against summertime flooding. The dikes would have a footprint of 3.3 acres, would require 18,700 cubic yards of fill, and could eliminate 1.9 acres of wetlands.

The removal of portions of the levees would increase the depth and frequency of flooding of adjacent lands at high flows downstream of the levees, but might reduce flooding at lower flows when the sandberm forms at the mouth of the creek — based on anecdotal reports from some residents that flooding of the agricultural lands has increased since the levees were constructed.

If flood easements were acquired in the lower Redwood Creek valley, the soils would be inundated more frequently and for longer periods of time. Soils would become more hydric and fertile as silt is deposited in the floodplain.

There would be minor temporary adverse impacts on estuarine wetlands from limited dredging in the estuary to deepen channels filled in with sediment of marine origin and sediment eroded from upstream watersheds.

Conditions that favor the growth of riparian and wetland vegetation would be reestablished by removing portions of the levees. The vegetation that develops would depend on sandberm development at the mouth of the creek, because the berm separates the saline ocean waters from the fresh water from Redwood Creek. Wetland vegetation would develop on some restored

wetland areas. Existing wetland vegetation might be inundated and replaced by another type of vegetation. There are historic reports that Sitka spruce became established following large floods in 1861–62 and 1890. Vegetated areas that became permanently flooded would lose existing vegetation or develop a different type of vegetation.

Impacts of Second-Growth Forest Management

There are about 7,900 acres of second-growth forest within 300 feet of perennial and intermittent stream channels. There would be very minor localized indirect adverse impacts on these stream channels from forest management within 300 feet of stream channels because of runoff of disturbed soils if heavy equipment was used to remove downed trees or if slash adjacent to stream channels was burned.

Impacts Related to Artificial Impoundments

Artificial impoundments at Marshall Pond and Lagoon Creek include shoreline areas that meet both the NPS and Army Corps of Engineer criteria for wetlands. RNSP staff would continue to monitor earthen dam structures for integrity and signs of failure that might constitute a safety hazard for people or a threat to significant resources. Should an evaluation of the physical condition of the dam result in a determination that the dam constitutes a significant threat to public safety or resources, RNSP staff would compare the risk posed by failure of the dam with the beneficial wetland values to determine whether the risk to public safety or resources outweighs the beneficial functions and values of the wetland. If public safety is determined to be the paramount value, and removal of either dam is proposed, replacement of lost equivalent wetlands would be required for mitigation.

Mitigation for removing Marshall Pond would include restoring and recontouring the natural stream channel, which would continue to provide habitat for amphibians. The removal of the dam and the restoration of a natural stream channel might increase the suitability of

Richardson Creek as native salmonid habitat and would increase the amount of habitat for these fishes. This would be an indirect benefit.

The use of Marshall Pond by breeding birds and aquatic wildlife would be considered along with other wetland functions and values that might be lost if the dam were removed.

Should the Lagoon Creek dam eventually begin to fail, RNSP staff would evaluate the beneficial wetland values and the safety risk to visitors to determine a course of action. Beneficial wetland values of Lagoon Creek include aesthetics, recreation, and wildlife habitat. The pond is stocked with rainbow trout by California Department of Fish and Game.

About 10 to 15 acres of forested pond and marsh habitat favored by some waterfowl species would be lost with the removal of Marshall Pond (5–10 acres) and Lagoon Creek (about 5 acres). There is relatively little forested pond habitat in the parks. Open-water marsh and pond habitats exist in the coastal lagoons and the Crescent Beach ponds. The coastal lagoons are primarily open water habitat. The Crescent Beach ponds are preferred by coastal bird species. Birds that use Lagoon Creek are commonly observed in other nearby habitats. Birdwatchers would lose a unique site in the parks if Marshall Pond were removed.

Impacts Related to Visitor Use and Circulation

Relocating the road, parking, and restrooms from Crescent Beach picnic area would result in restoring 0.5 acre of coastal palustrine wetland.

Adverse impacts on wetlands from road improvements along Davison and Gold Bluffs Beach roads would depend on the extent of improvements. Some widening, reconstruction of ditches, and replacement of culverts might directly affect wetlands.

There would be direct short-term but repeated adverse impacts on the approximately 900 square feet of riverine wetland near the Fern

Canyon parking area from annual maintenance and from vehicles driving through the streams on the approach to the parking area. Relocating the parking area would result in the restoration of about 20,000 square feet of wetland.

This alternative would result in minor benefits for wetlands and stream channels from drainage improvements and erosion prevention work on Cal-Barrel Road. These improvements would reduce the chances of catastrophic failure of the road and significant adverse impacts on stream channels and downslope wetlands.

Minor short-term adverse impacts and long-term benefits for stream channels would result from improving drainage structures and controlling areas with the potential for erosion and runoff into the streams along Howland Hill Road. Controlling possible erosion would reduce the possibility of major road failure and potentially significant adverse impacts on Mill Creek.

Minor adverse impacts from erosion and runoff into tributaries of Redwood Creek from the unsurfaced Tall Trees Grove access road would continue. Maintenance and repair of drainage structures and road failures would continue to affect small isolated wetlands and headwater stream channels in several drainages. Long-term adverse impacts on Redwood Creek would continue as sections of the road failed, with subsequent runoff and sedimentation into drainage and stream channels. Eventually, the sediment would be delivered into Redwood Creek. Road failures in the Emerald Creek drainages would result in sediment delivery upstream of the Tall Trees Grove.

There would be significant short-term adverse impacts on stream channels and isolated wetlands from the grading, dredging, and filling required for road construction along the Del Norte Coast Redwoods State Park entrance road. The new access road to the campground, with adequate drainage to reduce the potential of major failure, would have potentially significant beneficial impacts on the West Branch of Mill Creek. This would be a long-term benefit. Miti-

gation of adverse impacts would be prescribed when the site-specific impacts of the project are known. Mitigation would probably consist of restoring the affected stream channels to their original topography and hydrological function.

Minor adverse impacts on coastal drainages from erosion and runoff from the unsurfaced portions of the Coastal Drive would continue. The maintenance and repair of drainage structures and road failures would affect small isolated wetlands and headwater stream channels. Long-term adverse impacts on these drainages would continue as sections of the road failed, with subsequent runoff into and sedimentation of stream channels. A major road failure along the Coastal Drive would result in moderate to significant short-term adverse impacts from erosion and runoff, depending on the location of the failure. In the event of failure, removing the Coastal Drive and reconstructing it as a trail would result in short-term adverse impacts on small isolated wetlands and headwater stream channels. Minor impacts from erosion of bare soils following road removal and trail reconstruction would continue for one season until revegetation occurred. Long-term beneficial impacts on riverine wetlands in coastal drainages would result from restoring the original landforms and stream channels along the Coastal Drive.

Impacts of Education and Interpretation

A primary interpretive center constructed on the B-mill deck near Davison Ranch would indirectly benefit wetlands by providing educational opportunities for visitors. Wetland functions and the values of Prairie Creek, its associated wetlands and riparian areas, and wetlands that are being restored or re-created at the deck and ranch would be interpreted for visitors. Minor adverse impacts from runoff of petroleum products from the parking lot would be mitigated through construction of a drainage system designed to prevent direct contamination of Prairie Creek and its associated wetlands.

There would be a minor benefit on sandy shoreline and estuarine wetlands at the Redwood

Creek estuary when the Redwood Information Center was removed.

Impacts of Operations (Maintenance)

This alternative proposes that operational facilities in the south end of the parks be consolidated in the Orick area. Facilities constructed at a new site in the community of Orick might affect wetlands. Orick contains several areas identified as wetlands on the *National Wetlands Inventory* (USFWS 1987) maps. Seasonal rises in the water table at Orick require that sewage treatment options be analyzed for effectiveness and ability to prevent contamination of groundwater and adjacent reaches of Redwood Creek.

Conclusion

There would be long-term benefits for intermittent and perennial stream channels immediately downstream from areas where watershed restoration occurred. Primary drainage patterns would be reestablished, with major benefits where riverine wetlands were re-created after uncovering original channels. A greater benefit for stream channels would be expected downstream of areas where roads were completely removed, with fewer benefits anticipated for stream channels in areas with partial landform restoration. All downstream or downslope wetlands would benefit indirectly from restoring natural drainage patterns.

Improvements to Fern Canyon road access, and drainage and erosion prevention at Cal-Barrel, Howland Hill, and Coastal Drive would affect small areas of wetlands at stream crossings and drainages. The construction of a new entrance road to Del Norte Coast Redwoods State Park would have moderate adverse effects on wetlands, but restoring an equivalent amount of wetlands to replace lost functions and values would be required for mitigation. Removing the Redwood Information Center would be a slight positive impact on sandy shoreline and nearby estuarine wetlands. There would be a minor negative effect on wetlands under this alternative from retaining roads. Relocating the parking area

out of the stream at Fern Canyon would restore about 20,000 square feet of wetland.

Adverse impacts on wetlands in the Redwood Creek estuary from existing alterations of the creek and estuary for flood control, agricultural and residential development, and timber harvesting activities upstream would continue. There would be a long-term benefit on wetlands from removing levees and acquiring lands or conservation easements to allow flooding of agricultural land, thus avoiding the need to breach the estuary sandberm. The degree of benefit would depend on how much of the levees was removed and how much land was acquired or covered by a conservation easement.

There would be minor long-term benefits for coho salmon and other anadromous fish populations from restoring about 1,500 feet of stream channel at Marshall Pond and 1,500 feet at Lagoon Creek. There are other streams which, if restored, would have greater benefits for coho salmon, steelhead, and amphibians. There would be short-term adverse impacts on the soils and wetland vegetation at Marshall Pond and Lagoon Creek when the ponds were drained before the removal of the dams. Waterfowl habitat would be removed and replaced by anadromous fish and amphibian habitat. Visitor enjoyment of watching birds at the ponds would be decreased.

Cumulative Impacts

Watershed restoration within and upstream of the national park would have a moderate positive cumulative effect on wetlands. Partial restoration proposed under this alternative would result in minor to moderate cumulative long-term benefits for wetlands associated with the Redwood Creek estuary.

Vegetation management of second-growth forests and prairies and fire management would have minor cumulative benefits for palustrine and riverine wetlands from restoring original vegetation patterns and the processes that shaped the vegetation of the parks.

The maintenance and development of facilities, including public and administrative roads, camping areas, trails, and other facilities, would have minor adverse cumulative impacts on wetlands.

Threatened and Endangered Species

Impacts of Watershed Restoration

Watershed restoration conducted under the preferred alternative would result in long-term benefits for coho salmon and other anadromous fish by reducing the volume of sediment delivered into spawning streams. Where the potential for landslide erosion was not identified during field investigations before restoration, untreated road segments might pose a long-term threat to these fish because failures would result in sedimentation and continued impacts on spawning habitats. It is anticipated that more complete restoration would be conducted in those areas upslope and upstream of important fish-bearing tributaries of Redwood Creek, and other drainages where spawning habitat is threatened by road failure, so that the benefit to fish would be maximized. Additional failures of road segments over time would affect the regenerating forests on landslide areas, which would slightly reduce future marbled murrelet and spotted owl habitat.

Short-term benefits for these fish would be greater than under the current program because roads that pose the greatest threat to sensitive resources would be treated first. Long-term benefits for coho salmon, steelhead, owls, and murrelets would be greatest in those areas where roads are completely removed because there is less chance that a potential landslide site would be overlooked during field investigations. Forest fragmentation would decrease in some restored areas over 200 years, but the forest patches on the abandoned roads would not reattain the characteristics of mature forest outside the road corridors because of the lack of topsoil on abandoned roadbeds and lack of plant nutrients in road and cutbank surfaces.

Impacts of Estuary Restoration

Partial restoration of the Redwood Creek estuary under this alternative would improve habitat for tidewater goby and juvenile coho salmon and other anadromous fish; however, there would be substantially less benefit than if the estuary processes and configuration were completely restored and breaching was not conducted to manipulate water levels and control erosional threats to the Redwood Information Center. Improved survival of juvenile fish would eventually lead to an increase in populations of adults returning to spawn.

Impacts of Second-Growth Forest Management

The degree of benefit for northern spotted owls and marbled murrelets from second-growth forest management under this alternative would depend on whether the primary objective was to restore stand characteristics that favor the nesting of owls and murrelets, or whether other management strategies such as the restoration of tree species diversity or the removal of exotic tree species were assigned higher priority. However, this alternative would have long-term benefits on owls and murrelets regardless of the primary objective. Although studies in British Columbia indicated that murrelets avoid second-growth forests as much as 60–120 years old (Burger 1995) researchers in Oregon have recently documented murrelets nesting in 80-year-old second growth (Howard Sakai, RNSP supervisory ecologist, pers. comm., 12/12/97). The inland second-growth stands in the parks do not appear to possess the nest site characteristics (lichen mass and large lateral branches in proximity to overhead cover) for suitable nesting habitat (Sakai, *ibid.*).

Benefits for owls and murrelets relate to the difference between the time that silvicultural treatments such as thinning and canopy modification produce forests with suitable nesting habitat and the time that such habitat would develop without silvicultural treatment or manipulation of second-growth stands. Some areas peripheral to murrelet nest stands in mature and old-growth

forests could mature and become at least marginally suitable in 50 or (more likely) 100 years. Researchers have estimated that naturally occurring forest succession and regrowth augmented by silvicultural practices to mimic characteristics of older forests could result in increases in breeding population in 50 to 100 years (Ralph et al. 1995a). A reasonably conservative estimate of the time required for second-growth forest to acquire characteristics suitable for murrelet nesting is 100–200 years if the forest were allowed to mature without treatment.

The long-term benefits to owls and murrelets from second-growth forest management under the proposed action would be slightly fewer than the benefits from managing second-growth forests primarily to re-create old-growth components such as suitable nesting habitat. This alternative would result in slightly fewer benefits for northern spotted owls and marbled murrelets than an alternative under which second-growth forests chosen for treatment have the greatest potential to become suitable nesting habitat. This is because some sites would be selected for treatment under the proposed action with an objective of increasing visitor use and enjoyment of those sites rather than increasing suitable nesting habitat. Increased visitor use would potentially increase the chances of nest predation on owls and murrelets by corvids and other nest predators. Stands closer to highways, trails, campgrounds, picnic areas, and other developed areas are perhaps more susceptible to corvid nest predation on owls and murrelets than stands that are farther from the highways. Initial short-term impacts from an increase in nest predators attracted to human presence in a treatment area would be mitigated by treating these areas outside the breeding season or through methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

The treatment of second-growth forests would have a major long-term benefit on owls and murrelets by reducing the fragmentation of the forest. This benefit would be on the order of 50 to 100 years, or more. Reducing fragmentation reduces the potential for intrusion by predators,

which often move along edges between old-growth and second-growth forest (Nelson and Hamer 1995b). There would be short-term adverse impacts from disturbance and the presence of humans during silvicultural treatments, as well as impacts from an initial increase in the fragmentation immediately following treatment, before some regrowth occurs. This latter impact is on the order of one to several years. The presence of humans and disturbance would be short-term adverse impacts on the order of hours or days and would be mitigated by conducting treatments outside the breeding seasons for the birds or through methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

Silvicultural treatments designed to benefit owls and murrelets would attempt to create a canopy height of at least half of the site-potential tree height. Using a conservative estimate of 200 feet for the height of old-growth redwood and Douglas-fir forests, it is estimated that a treated second-growth forest would reach 100 feet in about 100 years. A multistoried canopy and snags would require at least 100 years following treatment. Snags can be created by girdling any large standing trees in an area. There would be little benefit to marbled murrelets from creating snags in a stand because these structures are not used by murrelets as nest platforms.

The short- and long-term benefits for spotted owls from second-growth forest management would be anticipated to be greater than the benefits for murrelets because owls do not need the large limbs and mossy branches required for murrelet nesting platforms, so there is an increased chance of successfully creating suitable owl nesting habitat in a shorter period of time. Spotted owls have been known to nest in forest stands as young as 40 years of age. Owls are expected to benefit from the management of second-growth forest lands in as little as 40 years, less than half the time that may be required for treated second-growth forests to develop as suitable murrelet nesting habitat.

This alternative would result in localized short-term adverse impacts on owls from the removal of some trees and the accompanying disturbance if some 40-year-old stands underwent second-growth forest management. However, the major long-term benefit as second-growth forests attain old-growth characteristics would be substantially greater than the short-term adverse impacts. There might be some benefit for spotted owls from opening dense second-growth stands. Clearing dense thickets in some second-growth stands would promote the establishment of understory shrubs and increase the suitability of these stands for owl prey species such as woodrats. Juvenile owls might be able to locate and pursue prey more easily in these stands, thus reducing the likelihood of starvation (Howard Sakai, RNSP supervisory ecologist, pers. comm. 12/12/97).

The characteristics of murrelet nesting habitat that would be expected to increase about 100 years after silvicultural treatment would include canopy cover and reduced fragmentation of the forest landscape, which now has cut blocks interspersed with old-growth forest. Forest fragmentation would almost certainly have decreased significantly within 200 years of treatment because of the favorable growing conditions in coastal redwood forest.

Estimates of second-growth forest lands that may be suitable after treatment for owl or murrelet nesting range from 37,000 acres for owls to 45,000 to 50,000 acres for murrelets. There are about 8,000 to 15,000 acres of previously cut forest habitat that are considered suitable for owls that are not suitable for murrelet nesting.

The estimate of time required, assuming that 500 acres of second-growth forest lands could be treated annually, is that 37,000–45,000 acres of minimally fragmented forest with characteristics suitable for northern spotted owl nesting would exist in as little as 70 years for the first 500 acres treated and as long as 175 years for all second-growth forest lands (37,000 acres @ 500 acres per year = 74 years to complete treatments + 70–100 years to grow = 144–174 years) or, for

45,000 acres 160–190 years to complete treatment (45,000 acres @ 500 acres per year = 90 years to complete treatments + 70–100 years to grow = 160–190 years). The range for completing treatment and developing suitable habitat for the owls then becomes about 145 to 190 years.

For marbled murrelets, a minimum estimate of time required for 45,000 acres of second-growth forest to become suitable nesting habitat is 190–290 years (45,000 acres @ 500 acres per year = 90 years + 100–200 years to grow = 190–290 years), with the first 500 acres of treated lands suitable in as little as 100 years. If 1,000 acres of second-growth forests were treated annually, the total time required for all second-growth forest lands to become suitable nesting habitat for owls and murrelets would be estimated to be 115–145 years and 145–245 years, respectively — that is 115–245 years, at least, for second-growth forest management to have some effect.

These are minimum time estimates assuming the best possible response to treatments in good growing conditions. The best growing conditions in parklands exist in alluvial groves. The alluvial redwood groves on the lower 8 miles of Redwood Creek upstream of the park boundary above the town of Orick and within 0.25 mile on either side of the creek were not harvested before the national park was established in 1968. Poorer growing conditions would be expected in other cut blocks that would be treated. The time needed for treated second growth to become suitable nesting habitat for murrelets would be longer under poorer growing conditions.

It is not known whether there is enough suitable old-growth nesting habitat to sustain local or regional murrelet populations during the at least 145 to 245 years required for treated forests to become suitable for murrelet nesting.

Silvicultural treatment of stands adjacent to stands inhabited by murrelets might improve the chances of population increase by providing suitable habitat adjacent to occupied habitat. If this were true, the selection of silvicultural

treatment areas adjacent to forest stands already occupied by murrelets would have greater long-term benefits than treating stands that are not adjacent to occupied stands.

Researchers found an increased chance of murrelet occupancy in landscape conditions with increased amounts of large saw timber and old-growth components within a 0.5 mile radius of a nest tree. Given the current knowledge, it is the best professional judgement of USFWS biologists that forested conditions exhibiting large saw timber and old-growth components within 0.5 mile of a potential nest tree contribute more significantly to occupancy than forest conditions beyond this distance (*Federal Register*, May 24, 1996, vol 61, no. 102).

The treatment of second-growth forest lands adjacent to stands currently occupied by murrelets might also result in a minor long-term benefit for both murrelets and owls by buffering forests with nest stands from loss due to windthrow (Ralph et al. 1995a).

Stands on ridges and in small drainages have fewer incidents of occupied behavior (see glossary) of murrelets than stands at lower elevations and in major drainages (Miller and Ralph 1995). The selection of treatment areas at lower elevations in larger drainages would increase the amount of suitable nesting habitat to a greater extent than treatments on ridgetops in smaller drainages.

Short-term adverse impacts from noise and disturbance from second-growth forest management actions on murrelets and owls in adjacent occupied stands would be avoided through conducting the treatments outside the breeding seasons, or through other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

Impacts from Prairie Restoration

Prairie restoration in the Bald Hills would result in minor direct short-term adverse impacts on spotted owls and murrelets from smoke from

planned fires drifting into occupied stands. Prairie areas to be restored would be surveyed for the presence of owl activity centers. Adverse impacts on owls and murrelets would be avoided by conducting burns where smoke would not affect birds or by conducting burns after the nesting season. Fire prescriptions would be established to avoid major adverse impacts from smoke that drifts into forests used for nesting by owls or murrelets. Prescriptions to reduce smoke impacts would include actions such as adhering to air quality standards for burn days.

The removal of Douglas-fir greater than 18 inches diameter at breast height or greater than 40 years of age from prairies — potential northern spotted owl nesting habitat — might result in minor adverse impacts on northern spotted owls. The impact would not be significant because of the amount of more suitable habitat available in the forests adjacent to the prairies. Direct adverse impacts on owls would be avoided through surveying conifers to be removed. If owls were nesting in any Douglas-fir tree, the tree and surrounding trees would not be removed.

Impacts of Fire Management

Implementing a prescribed fire program of low-intensity fires would encourage natural patterns and processes of soil development, vegetation succession, pest control, and wildlife use of forests to continue. Continuation of natural processes would indirectly benefit threatened and endangered species that inhabit the ecosystem.

Conducting prescribed burns in any vegetation type would reduce fuel loads. Fuel buildups might eventually lead to catastrophic fires (fires that might result from long periods of fire suppression) that would have significant direct and indirect short- and long-term adverse impacts on vegetation and wildlife. Direct short-term adverse impacts of catastrophic fire include smoke, heat, and destruction of vegetation and less mobile wildlife. Long-term adverse impacts of catastrophic fires are reduced habitat for

marbled murrelets and northern spotted owls and the destruction of riparian vegetation that creates shade in streams used by coho salmon and other anadromous fish. Short-term indirect adverse impacts from fire suppression include the noise and disturbance from fire suppression equipment and personnel. Long-term indirect adverse impacts might include the construction of fire breaks and fire access trails in suitable marbled murrelet and northern spotted owl habitat, which might also introduce sediments from erosion and runoff from severely burned areas, fire breaks, and fire roads into spawning streams of coho salmon and other anadromous fish.

A prescribed fire program would allow the location, timing, and extent of the fire to be controlled, reducing direct adverse impacts on northern spotted owls and marbled murrelets from drifting smoke or destruction of nesting habitat. Prescribed fires of low intensity could reduce fuel loads in understory vegetation without the loss of trees that might occur during catastrophic fires. Although high-intensity fires that destroy whole stands of large trees are unknown in intact old-growth redwood forests in the parks, a fire destroyed old-growth and second-growth redwood forest on private timberlands just north of the town of Klamath in 1988 (NPS 1994).

Underburning (burning the understory vegetation) would reduce unnatural fuel buildup. Wildland fires in forest stands that have had undergrowth reduced through prescribed fire are less severe, which increases the effectiveness of suppression efforts when needed and reduces the duration and extent of noise and disturbance to owls and murrelets. However, the reduction of understory vegetation reduces forage and nesting habitat for spotted owl prey species such as the dusky-footed woodrat that use the brushy areas for forage, nesting, and cover. The benefits of restoring fire as an ecological process to the parks' forests are anticipated to outweigh the adverse effects on the owl prey base.

Disturbance to owls and murrelets from prescribed fires would be avoided by surveys to

locate owl territories and occupied murrelet habitat as part of project planning for old-growth burns. Unless pre-burn surveys indicate the absence of marbled murrelets and the U.S. Fish and Wildlife Service concurs that no murrelets would be affected, any prescribed fires in old growth would be scheduled outside of the nesting season to avoid direct adverse impacts on nesting birds, to the greatest extent possible given the weather conditions needed to conduct prescribed burns.

Impacts Related to Artificial Impoundments

Removing the dam at Marshall Pond and restoring the stream channel to its original contours would directly benefit coho salmon and other anadromous fish by restoring 1,500 feet of spawning habitat.

There is no information on whether the original stream channel at Lagoon Creek was occupied by coho salmon or steelhead. If there was suitable habitat, it was likely occupied by steelhead, coastal cutthroat trout, and coho salmon. A long-term minor benefit for these fish would be anticipated if the stream were restored following removal of the impoundment.

Impacts Related to Visitor Use

Trail connections between the Coastal Trail and the Redwood Creek basin are tentatively identified as passing through an area of second-growth forests east of Highway 101 and downslope of Lady Bird Johnson Grove. Eventually, the forest here would reattain old-growth characteristics and be suitable nesting habitat for marbled murrelets and northern spotted owls. RNSP biologists anticipate that more research and better understanding of population dynamics and population status of marbled murrelets and owls would make it easier to assess direct site-specific impacts from trail construction and visitor use of this area. Traffic noise from Highway 101 at the base of the slope would likely be significantly greater than noise and disturbance from trail use. The construction of this trail segment would not

be anticipated to adversely affect marbled murrelets or northern spotted owls.

The area most suitable for connecting the Coastal Trail to Jedediah Smith Redwoods State Park is currently private land being managed for timber production. Should the parks acquire this land or an easement for the trail connection, no adverse impacts on marbled murrelets or northern spotted owls would be anticipated because there is no suitable owl or murrelet habitat.

Currently, 54% of old-growth forest (22,240 acres) in the parks is within 0.25 mile of existing trails. Construction of the East Side Trail along the east side of the Redwood Creek basin between Highway 101 and the Tall Trees Grove, plus the Skunk Cabbage Groves trail on the hill southwest of Davison Ranch, would result in 60% of old-growth forest (24,530 acres) being within 0.25 mile of trails. The construction of all trails included in approved RNSP planning documents would result in 69% of old-growth (28,200 acres) being within 0.25 mile of a trail, which might result in an impact on owl and murrelet nestlings if human use of trails attracts nest predators.

The construction of new segments of horse trails on the west side of the Redwood Creek basin and new segments of horse and mountain bike trails at Davison Ranch would increase noise and disturbance and potentially could attract predators to marbled murrelet nests. These impacts would likely result in a moderate adverse impact on northern spotted owls and marbled murrelets because approximately 3,700 more acres of forest would be within 0.25 mile of new horse and mountain bike trails.

Impacts of Visitor Access and Circulation

The impacts on threatened and endangered species from proposals related to visitor access and circulation are similar to those described under "Impacts from Visitor Use." These impacts are primarily on birds that inhabit areas near road corridors and result from noise and

disturbance due to road maintenance and from traffic on the roads. The impacts on threatened and endangered species from proposals relating to visitor access and circulation would be the same as the impacts from general development, general facility maintenance, or visitor use of highways. The degree of impact varies with the location of the road, because the roads pass through different habitats of varying quality.

Vehicle traffic on roads and highways and maintenance of these facilities results in variable noise levels. Trucks braking on steep hills, such as Bald Hills Road near Lady Birds Johnson Grove, make short-term, intense noise that is repeated daily. There would be minor to moderate repeated adverse impacts from continuing noise and disturbance from vehicles on those roads that pass through old-growth forest and have the most use (Bald Hills, Newton B. Drury Scenic Parkway, Howland Hill Road). The use of the other roads in old-growth forest is occasional and short term and would result in minor adverse impacts.

Noise impacts due to maintenance of roads could be mitigated by (1) conducting the activities outside the breeding season, (2) restricting the noise to very short periods in the middle of the day, (3) surveying for the presence of birds and not conducting maintenance activities if nesting birds were present, or (4) other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

Impacts on northern spotted owls and marbled murrelets would be least likely to result from maintenance or use of the Davison Road-Gold Bluffs Beach Road along the beach and portions of the Tall Trees Grove access road, because large sections of these roads are not in old-growth forest habitat suitable for owls or murrelets. Adverse impacts that might result from providing an alternative entrance road to Del Norte Coast Redwoods State Park would depend on the location chosen for the new road, because forest habitat would be removed to construct a new entrance road. Without detailed information on the location and size of the new road, it is not

possible to determine the magnitude of the impact.

Conclusion

Watershed restoration would result in long-term benefits for coho salmon and other anadromous fish by reducing the threat of sediment delivered into spawning streams. The reduction of sediment would maintain the stability of existing deep pools and spawning gravels for salmonids. Watershed restoration would also increase the potential numbers and depth of pools and encourage the development of streamside vegetation, which would help maintain cooler water temperatures and provide cover for salmonid juveniles. The potential increase of turbidity in streams adjacent to rehabilitated roads until slopes were revegetated and the removal of some small trees along riparian areas would constitute short-term adverse impacts on salmonids.

This alternative would result in moderate long-term improvement of estuarine habitat used by tidewater gobies, coho salmon, and steelhead. The degree of improvement would depend on the success of the RNSP staff in obtaining the cooperation of adjacent landowners to acquire land or conservation easements, and on landowners' acceptance of partial levee removal and changes in water levels.

This alternative would be expected to increase the suitable nesting habitat for northern spotted owls and marbled murrelets in Redwood National and State Parks through the treatment of about 45,000 acres of second-growth forests. If all treated lands attained characteristics suitable for murrelet nesting, suitable nesting habitat in Redwood National and State Parks would increase from 43,000 acres to 88,000 acres. The time expected for this benefit to occur would be at least 145–245 years. The benefit for northern spotted owls would be anticipated to be greater and would be realized sooner (40–190 years) because owls have less restrictive nesting requirements than murrelets and are known to nest in much younger forest stands.

The restoration of second-growth forests would result in long-term benefits for owls and murrelets from an increase in nesting habitat and a decrease in habitat fragmentation. There would be short-term adverse impacts from noise and disturbance. The long-term benefit would be anticipated to outweigh the short-term adverse effects of disturbance. Short-term adverse impacts from noise would be reduced by timing the work to avoid the breeding season or other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service. The greatest positive effect would be anticipated in those second-growth forest stands that are adjacent to old-growth stands already occupied by marbled murrelets.

The benefit for owls and murrelets under the proposed action would be lessened to the degree that restored second-growth forests were used by visitors and had developments that resulted in noise and disturbance and increased nest predator populations.

Cumulative Impacts

The proposed action would have a moderate long-term positive cumulative effect on coho salmon and other anadromous fish from watershed restoration by improving the water quality and spawning habitat in RNSP streams, and to tidewater goby by improving the water quality and spawning habitat in the Redwood Creek estuary.

The degree of cumulative benefit for tidewater goby habitat in the Redwood Creek estuary would depend on the degree of estuary restoration. Removing levees would result in positive cumulative effects on tidewater goby habitat. The restoration of the Redwood Creek estuary (partial levee removal, flood easements, and discontinued breaching) would result in major long-term benefits for the tidewater goby, coho salmon, and steelhead by restoring habitat.

Habitat destruction in the region has resulted in a significant cumulative adverse impact on northern spotted owls and marbled murrelets.

Proposals under alternative 1, the proposed action, would have a moderate long-term positive effect on marbled murrelets and northern spotted owls due to the restoration of suitable habitat through managing second-growth forests and restoring damaged watersheds.

The maximum estimate of 45,000 acres of suitable murrelet habitat following restoration would increase available habitat in the Pacific Northwest by about 1% and suitable habitat in northern California by about 6% ($45,000 / 3,887,800 = 0.01 \times 100 = 1\%$; $45,000 / (477,300 + 175,500 + 40,400)$, which is the designated murrelet critical habitat in northern California) = 6.49%). This increase in suitable habitat would have a minor to moderate positive cumulative effect on the population as a whole from increasing the available habitat and reducing the fragmentation of the habitat. The effect of increasing habitat suitable for marbled murrelet nesting by 45,000 acres would have a substantial positive cumulative effect on the parks' population of murrelets. There would also be a minor to moderate positive cumulative impact on northern spotted owls from increasing suitable nesting habitat.

Continuing timber harvest outside the parks of stands occupied by marbled murrelets would result in a reduction of the overall population of marbled murrelets. This is a moderate to significant short-term direct adverse impact on individual birds and a moderate to significant direct adverse impact due to loss of nesting habitat. The relation between adverse impacts on murrelets from timber harvesting and the stability of RNSP populations is unknown.

Conducting a fire management program including prescribed fire and wildland fire use in all vegetation communities would result in a long-term moderate positive cumulative benefit for threatened and endangered species.

Providing more trails and campsites in old-growth forests would increase visitor use and require maintenance, which would have a moderate adverse impact on northern spotted

owls and marbled murrelets. Maintaining and constructing facilities for RNSP operations would likely have a minor adverse impact. The cumulative adverse impact on marbled murrelets and northern spotted owls in the region from increasing visitor use and development in the parks would be minor.

IMPACTS ON CULTURAL RESOURCES

New facilities — the parks' primary visitor center, the Hiouchi area visitor center, and the Del Norte Coast Redwoods State Park entrance station; trailheads and trails; picnicking and campsites; and wayside exhibits — would be sited to avoid adversely impacting known cultural resources, including potential cultural landscapes.

Salvaging the nonhistoric Redwood Information Center and converting the surrounding area to day use, including beach access, boardwalks, and wayside exhibits, as well as removing the nonhistoric Hiouchi information center would have no impact upon the parks' cultural resources.

Before converting the Coastal Drive, which is listed on the National Register of Historic Places, to a trail, the effects of the action would be evaluated in consultation with the California state historic preservation office and the Yurok tribal heritage preservation officer. If the road was determined eligible for the national register, conversion of the road to a trail could proceed after following applicable consultation procedures.

The removal of nonhistoric, noncontributing features from the parks' potential cultural landscapes, such as the CDPR facilities in Elk Prairie, as well as other buildings, structures, and roads, would improve the integrity of the landscapes by returning the landscapes to more of a semblance of their historic appearances. However, no landscape features would be removed from any of the parks' potential cultural landscapes until either cultural landscape inventories

or reports had determined that the features did not contribute to the integrity of the associated cultural landscape.

Expanding and enhancing the curatorial program of Redwood National and State Parks would improve the preservation, research, and interpretation of the parks' collections. In addition to better preserving museum artifacts and archival materials, the curatorial program would improve recordkeeping and the retrieval of information pertaining to the management and administration of the parks.

Conclusion

Implementing the preferred alternative would benefit cultural resources by creating more of a similarity in program emphasis among the parks' cultural and natural resources, interpretation, and visitor use. With appropriate mitigation, there would be no adverse impacts on RNSP cultural resources

Cumulative Impacts

Cumulative impacts would result from the continued use of campsites and mountain bike trails near sensitive cultural resources. Cumulatively, cultural resources would benefit from the following:

- Assistance that could be provided to protect cultural resources affected by landform restoration outside of the parks' boundaries.
- Removal of noncontributing, intrusive features from the parks' cultural landscapes.
- Increased public understanding of and sensitivity to the importance of the parks' cultural resources.
- An expanded and enhanced curatorial program.

IMPACTS ON VISUAL QUALITY

Due to the inherent visual sensitivity of landforms and land cover within this region, watershed and vegetation management actions under this alternative could result in appreciable impacts on visual resources. These impacts would be most visible on forested and open hillsides as well as open flat areas, such as estuaries. Actions altering terrain or vegetation could impact the line, form, color, texture, and visual density of the landscape. Impacts would affect visual experience in both micro and macro landscapes. The watershed restoration and vegetation management activities specified in this alternative would be likely to have primarily short-term negative visual impacts, ultimately resulting in long-term visual benefits.

Within visually sensitive areas, management actions intended to enhance or remove signs of human occupation, such as old roads, could have some short-term negative visual impacts.

Visitor use and interpretive actions could strongly influence observers. However, this alternative limits visitor use to levels that would result in minor impacts on resources and their values. Relatively low negative visual impacts associated with visitor use and interpretation activities would be anticipated.

Removing or relocating access roads, parking areas, trails, and associated facilities in visually sensitive areas might result in short-term negative visual impacts primarily affecting micro landscape experiences. Providing additional hiking, equestrian, and mountain biking trails as well as picnic and camping facilities should have a beneficial impact on long-term landscape viewing experiences. Also, an increase in pull-outs, waysides, and selected viewsheds would have a beneficial impact by creating an appreciable increase in macro landscape viewing opportunities. The development of a centralized, primary interpretive center outside of a sensitive visual resource area could result in some minor negative visual impacts. Overall visual quality would greatly depend on project-specific visual

analysis and design for all actions resulting in the removal, relocation, or installation of visitor use and interpretive facilities.

Coastlines and coastal environments are highly sensitive visual resources due to intensive dynamic contrasts and extensive viewsheds. Extensive overnight vehicle camping activities along the highway corridor and adjacent beachfront at Freshwater Lagoon Spit result in overwhelming visual contrasts that strongly impact the indigenous landscape character. Eliminating overnight camping on Freshwater Lagoon Spit would impact this visual condition by restoring much of the area's natural visual character.

Community planning actions related to watershed protection and acquisition of lands with significant scenic value would greatly enhance the preservation of regional landscape character. Identifying and protecting visual/scenic resources along highway corridors and roads could result in substantial long-term visual benefits. Negative visual impacts resulting from new road development or road maintenance activities would probably be relatively minor in this alternative.

Conclusion

Under this alternative there would be relatively minor negative visual impacts on visual and scenic resources. Most negative impacts would be short term and ultimately result in long-term visual benefits. Overall, visual and scenic quality would directly depend on project-specific visual analysis studies and design implementation. Harvested areas in Redwood Creek basin near high visitor use areas would be restored first and over time, the lower basin would become more aesthetically pleasing and have a more natural appearance for RNSP visitors. Revegetation of the area would occur soon after restoration activities were completed, but restoration of the visual appearance of an old-growth redwood forest would take decades or more to occur, a minor beneficial impact. Coastline management

and watershed protection actions would enhance landscape character and result in major long-term visual and scenic benefits.

Cumulative Impacts

Cumulative visual and scenic impacts include those previously occurring within and surrounding RNSP properties as well as those identified under this alternative. Previous land use activities have impacted the indigenous visual character of virtually all landscape units. The major cumulative visual impacts of extensive timber harvesting, road and highway alignments, and other development activities would remain highly visible throughout the region. Under this alternative watershed restoration activities and the identification and reduction of impacts in visually sensitive areas as well as coastline management and watershed protection actions would have a cumulative long-term beneficial impact on visual/scenic resources.

IMPACTS ON VISITOR ACCESS AND CIRCULATION

Not repairing the Coastal Drive and making it a trail if the road failed would eliminate vehicle access to portions of the coast south of the Klamath River and connections to Newton B. Drury Scenic Parkway and would eliminate one access to Alder Camp.

Because this alternative retains the internal road system in its current condition, impacts on circulation under the preferred action would generally be minor. Only minor improvements on Cal-Barrel Road, Howland Hill Road, Davison Road, Tall Trees access road, etc, are proposed. The minor changes that would occur would result in a slight improvement in circulation.

There would be circulation impacts near the proposed developments such as the new primary interpretive center in the B-mill deck vicinity and the new Hiouchi information center. These

centers would become main attractions, and there would be an increase in localized traffic around these facilities. This increase in traffic would be offset by a decrease in traffic around the Redwood Information Center. Improved circulation on U.S. Highway 199 would occur at the new Hiouchi center and when the entrance to the Jedediah Smith Redwoods State Park campground was relocated.

IMPACTS ON THE QUALITY OF THE VISITOR EXPERIENCE

Visitor Use Opportunities

Although visitor access to sensitive natural resource areas would be reduced from their current levels, visitors would continue to have some opportunities to experience those resources directly. At most sensitive cultural resource sites, access would be limited to those visitors physically able to hike and those who can find the sites on their own. These two factors would diminish the number of visitors who visit these sites.

Visitors would have more camping opportunities. During peak visitation periods fewer visitors would be forced to seek camping outside the parks. If additional campgrounds were constructed, visitors would have more choice and flexibility in their decision of where in the parks they want to camp, and this could moderate crowding at individual campgrounds. Visitors seeking primitive camping experiences would have even more opportunities than those provided for in current plans when more primitive campsites were built. Although camping at Freshwater Lagoon Spit would be eliminated, the area's conversion to a day use area would allow more visitors to enjoy an easily accessible beach with picnicking facilities. Eliminating camping at Freshwater Lagoon Spit would provide a generally more aesthetically pleasing and parklike initial view as visitors enter the southern entrance of the parks.

More trails and more trail connections for all types of trail users (hikers, bicyclists, and equestrians) would give visitors greater access to RNSP resources and allow visitors more flexibility in choosing and planning trail experiences to meet their own needs and desires. Regional trail connections would allow visitors to expand their experiences to trails outside the parks.

Visitor access to a variety of driving opportunities would remain at current levels. Failure of the Coastal Drive would result in the loss of a driving opportunity, but would also result in an additional trail.

Because visitors would lose the opportunity to drive on the beaches, and vehicles would only be allowed in relation to commercial surf fishing at Gold Bluffs and Crescent Beaches and Freshwater Lagoon Spit, and in relation to American Indian traditional activities at Gold Bluffs Beach, beach users would benefit from some reduction in the number of vehicles on the beach. Visitors would lose some recreational opportunities, mainly fishing and wildlife viewing, if artificial impoundments were removed.

Newton B. Drury Scenic Parkway would continue as a through road, allowing some local casual and commuter traffic to mix with park-specific traffic, making the road more congested and less parklike than if the road was closed to through traffic.

Orientation, Information, and Interpretation

The new primary interpretive center in the south part of the parks would provide visitors with opportunities to learn about the parks' significant resources and primary interpretive themes at a much more comprehensive level than the introductory information currently available at the parks' visitor facilities. The location, close to primary resources, would allow visitors to reinforce and immediately apply the knowledge gained at the facility — which for many visitors would give them a greater understanding and

appreciation of those resources. The use of a variety of media would lessen visitors' dependence on direct interaction with trained interpretive staff to provide in-depth interpretation and accommodate visitors' different learning styles and preferences.

The new information center at Hiouchi would give visitors entering the parks from the north the opportunity for a more thorough orientation to the parks, their resources, and available activities. Better oriented, more knowledgeable visitors would be more likely to make choices that disperse their use of the parks and might lead to fewer impacts on individual resources. Using media to provide more of this orientation and information function would make visitors less dependent on direct contact with limited RNSP staff. Visitors would be less likely to miss destinations and attractions because of the lack of information. The Hiouchi center would also provide visitors with more in-depth and comprehensive interpretive messages about RNSP resources and primary interpretive themes than is possible in the current facilities. The new facility would provide visitors more comprehensive interpretive and orientation services than the two separate centers can, and the consolidation would increase staffing and operational efficiencies for the parks.

Moving the functions of Redwood Creek Information Center to the new visitor center near B-mill deck when the new primary interpretive center was completed would have little impact on visitors.

Visitors would have the opportunity to understand and appreciate RNSP resources and processes from a variety of perspectives. Some interpretive experiences would occur in sensitive resources areas where those experiences could have the most effect, providing a direct connection between resources and their significance. The improvements in interpretive opportunities in the Bald Hills area would increase visitors' awareness and appreciation for cultural and natural resources located there.

Expanding the use of the outdoor schools for community and education groups in the summer and winter would increase the educational opportunities in the parks and more students would benefit.

Conclusions

Opportunities for visitor use would be expanded beyond current levels. Visitors would have some limited additional opportunities to directly experience sensitive resources, although these resources would be well protected. Visitors would be more knowledgeable about their opportunities to see and do things within the parks. Both the number of visitors and the time they spend in the parks would probably increase under this alternative. Visitors would have more opportunities to increase their knowledge, understanding, and appreciation of the parks' resources and primary interpretive themes.

Cumulative Impacts

This alternative would have an overall moderately positive impact on visitor use and a very positive impact on interpretation. Visitors would generally have more opportunities to see and experience the parks, and visitors would have more opportunities to increase their knowledge, appreciation, and understanding of RNSP resources.

SOCIOECONOMIC IMPACTS

Visitor Use Impacts

Under the proposed action, the development of visitor facilities would occur inside RNSP boundaries and on the main highways running through the parks (both within and outside the boundaries). Most of the improvements under this alternative, although many would be relatively minor, would support expanded visitor use.

The improvements envisioned under alternative 1 would be expected to attract substantial numbers of visitors to the parks, beyond the historical levels and growth trends that are discussed under the no-action alternative. For purposes of analysis, it is assumed that a destination lodge would be developed soon after the turn of the century, which is a planning assumption for purposes of analysis, and that the lodge would be at a site that would allow easy walking access to the RNSP trail system. (Note that this lodge would not be directly instigated or funded by the National Park Service or the California Department of Parks and Recreation, but with cooperative planning and trail links, its development could be stimulated by actions proposed in this joint plan and is therefore analyzed in this document.)

A number of destination lodge concepts are discussed in Market Value Planners' *Yurok Lodge Project Review and Pre-Architectural Programming/Feasibility Scoping*, a report commissioned by the U.S. Department of Commerce, Economic Development Administration, and the California Department of Housing and Community Development, California Indian Assistance Program. The report describes a national park lodge concept, which includes a hotel of about 150 rooms, organized guest activities, and development costs of \$30 to \$35 million. Assuming that this lodge would be developed after the turn of the century, the net affect on visitor use of the parks would be positive, but modest, in terms of contributing additional visits. Of course visitors staying at the lodge would include guests who would visit the parks. Hence, the net increase in visitation at the parks would be some percentage of total lodging stays (total occupancy days divided the number of guests). This is because many lodge guests would have visited the area including the parks even if the destination lodge did not exist. A reasonable approximation of the expected net increase of RNSP visitation generated by the destination lodge would be half of the lodge guests.

To determine the influence of a destination lodge on RNSP visitation, it is necessary to make a number of additional assumptions concerning occupancy levels (during peak and nonpeak seasons), guests per room, and average stay (average number of overnight stays). These assumptions would be allowed to vary over the period of the projection horizon (20 years) to account for the maturation in the destination lodge market in the area. Thus, occupancy levels during high peak season (April 1 to September 30) would likely be 75% during the first year or two of operations and rise to 90% by 2016.

Similarly, occupancy during the nonpeak season (October 1 through March 31) would be 25% during initial operations and about 40% by the end of the projection horizon (the year 2016). Guests per room would be expected to average 2.0 persons initially and rise to 2.4 persons over time. Average overnight stays would begin at two nights and increase to three nights by the end of 20 years (2016). Based on a 150-bed lodge/hotel, these assumptions would imply a total of about 22,000 guests annually in the initial period and 28,000 by the year 2016. Assuming that half of the guests would visit the parks, this would result in a net increase in visitors to the parks ranging from about 11,000 in the initial period to 14,000 by the year 2016. Therefore, lodge development would have only a moderate influence on RNSP visitor use.

For the purposes of projecting visitor use at the parks under the proposed action, it would be anticipated that visitor growth would be substantially greater than under the no-action alternative. For the no-action alternative, it was assumed that visitation would grow at a rate consistent with long-term trends, based on NPS visitation data, or an average annual rate of growth (AARG) of 2.5%. A lower average annual growth rate of 1.8 %, based on CDPR data, would also be applied to the state counts of overnight camping visitors at the three state parks within Redwood National and State Parks. (Details of the historical visitation at the parks and related growth trends are presented in the analysis under the no-action alternative.)

The growth rate under alternative 1 would likely be higher — 3.5% average annual rate of growth based on NPS 1990–96 visitation data instead of 2.5% based on long-term trends — because of the expanded facilities proposed under alternative 1. The 1.8% average annual rate of growth referring to the historical growth in visits to the three state park campgrounds should also be applied to project campground visitors in state parks. Also, half of the lodging guests at the proposed destination lodge facility should be counted as visitors and should be included in the projected visitation totals. Projected visitor use during the next 20 years under the proposed action is presented in five-year intervals, in table 25.

Regional Economic Impacts

The proposed action would have a substantial beneficial impact on employment, earnings, and expenditures. Following 1990–96 patterns, there would be healthy long-term growth in businesses and services related to tourism. Visitor interest would continue to be concentrated on the highway corridors, existing and new information centers, Lady Bird Johnson Grove, Redwood Creek, developed campgrounds, and picnic areas. In addition, there would be considerable visitor interest in RNSP interpretive programs that focus on both natural and cultural resources.

The use of backcountry hiking, biking, and horse trails and primitive camping areas would also expand under the proposed action. Finally, the proposed destination lodge would attract many visitors seeking accommodations as well as recreation and education opportunities.

Major construction for visitor facilities would take place under the proposed action, resulting in substantial regional economic activity. (Details of the construction program under this alternative as well as for the other plan alternatives are presented in appendix A.) Construction and other development activities are expensive and also provide jobs and earnings for local and nonlocal workers. Visitor use generates visitor expenditures for lodging, meals, tours, recreational activities, etc. Visitor expenditures provide employment and income for workers such as hotel/motel and restaurant employees, equipment rental providers, and transportation workers.

The cost of implementing NPS/CDPR programs for protecting, preserving, and restoring cultural and natural resources would be similar to the actions discussed under alternative 3; however, watershed restoration of the Redwood Creek estuary would be less extensive under this alternative and current land uses in the lower valley would be retained to the extent possible. Water level management would continue.

TABLE 25: PROJECTED VISITOR USE UNDER THE PROPOSED ACTION

Year	RNSP-Related Visits (NPS Data ^a)	Camping Visitors (CDPR Data ^b)	Lodge Visitors ^c	Total Visits
2001	570,096	158,529	10,969	739,594
2006	677,103	173,319	13,068	863,490
2011	804,195	189,490	13,800	1,007,485
2016	955,143	207,169	14,040	1,176,352

a. Based on 480,000 visitors in 1996 and future growth of 3.5% per year.

b. Based on 145,000 visitors in 1996 and future growth of 1.8% per year.

c. A visitor lodge is expected to be built after the turn of the century. The visitor figures for 2001 and beyond are provided for illustrative purposes.

Construction activities under the proposed alternative, such as new visitor facilities and access improvements would total about \$45.9 million (in 1998 gross construction dollars). (This figure exceeds the total in appendix A because it includes the development of a privately funded lodge that would be encouraged under this alternative and the south operations center.) Because these facilities would be funded from special authorizations through Congress or the California Legislature, they would not affect the parks' budgets; however these facilities would affect RNSP operating costs and generate incremental changes in regional economic activity. The proposed destination lodge would be developed and operated through a cooperative arrangement with other public or private partners. However, construction finance would come from non-RNSP sources. Construction costs for the lodge are estimated at \$30 million and about \$3.4 million for the new NPS visitor and information centers and operational facilities in 1998 dollars. The impacts from construction activities would be short term, occurring only during the construction period.

RNSP operations would be expected to increase with staffing and real funding levels rising modestly above current levels by about 12% or 17 full-time equivalent (FTE) positions to support expanded visitor use and operate new interpretive and information facilities as well as campgrounds. (Full-time equivalent is a way of combining part-time positions into numbers that can be compared to full-time employees. For example, four part time employees who each work for three months of the year are equivalent to one full-time, year-round employee.) Redwood National and State Parks have 139 FTE positions (116 full-time and 90 seasonal positions, with each seasonal position representing about one-fourth of a full-time equivalent position) and an operating budget of \$7.2 million. Of those totals, the California Department of Parks and Recreation has 18 permanent and 28 temporary employees (peak season) for an FTE count of about 32 positions and an operating budget of \$1.1 million.

Visitor use impacts on the local economy would be substantial under the proposed action. The analysis of such impacts is performed by first estimating the number and length of visitor stays and expenditure levels for goods and services purchased by visitors to the parks within the two-county (Humboldt and Del Norte) regional economy. The visitor projections presented above in the year 2006 (the 10th year of the projection horizon) are assumed to reflect an average that can be used as a basis for comparing the alternatives.

Visitor and agency expenditures are the basis for estimates of regional employment and earnings directly associated with such expenditures. It is estimated that RNSP operation levels would be about \$2.3 million (a 32% increase over the existing operation levels) to reflect staffing and operations and maintenance cost increases associated with implementing alternative 1.

A U.S. Forest Service economic modeling program (IMPLAN 1991, F version) was used to estimate the impact of direct visitor/tourism expenditures and expenditures for RNSP operations on spending for local goods and services by businesses and households (direct recipients). The study area for the IMPLAN model is Humboldt and Del Norte Counties. Details of the impact analysis are presented in a separate paper titled "RNSP – Regional Economic Impact Analysis" which is on file at RNSP headquarters in Crescent City (Hansen 1999).

There would be enhanced employment and income-generating opportunities. The construction of proposed RNSP improvements, the development of a lodge, and the costs for road improvements, site restoration, building construction, site utilities, landscaping, and campground development would be anticipated to total \$45.9 million (in 1998 dollars) under the proposed action. Construction would generate about 393 direct and 824 total jobs, with estimated direct and total earnings of \$15.8 million and \$29.5 million, respectively, in 1991 dollars. It is likely that a substantial portion of the jobs and earnings would go to local workers. (Note

that this impact includes 441 indirect or induced jobs that would be created by the money recirculating in the local economy, sometimes referred to as a multiplier effect — see definitions for indirect and induced below. Also note that 1991 is the year upon which the IMPLAN model is based, so impacts are stated in 1991 dollars.)

With RNSP-related visitation at 863,490 visitors in the year 2006, along with a modest (12%) increase in RNSP operations staffing, the associated direct and total (including indirect and induced components, see explanation in box below) employment would amount to 1,394 workers and 2,641 workers, respectively, due to visitor spending and RNSP operations within the two-county region. This compares to 941 direct workers and 1,841 total workers estimated for 1996 baseline conditions and 1,269 direct workers and 2,413 total workers estimated for the no-action alternative in year 2006, for a total net increase of 228 total workers compared to the no-action alternative. (The increases in workers as well as earnings changes are discussed in greater detail in a separate paper titled “RNSP – Regional Economic Impacts Analysis.”)

Earnings associated with direct employment would amount to \$23.4 million; total earnings would be \$61.9 million in 1991 dollars. These measures of economic activity would be associated with \$46.2 million in direct purchases by

RNSP visitors and associated visitor expenditures and \$108 million in gross output within the region, also, in 1991 dollars. The additional regional economic activity associated with increased visitor use and their expenditures, above baseline levels, is due to the influence of general growth in recreation/tourism and specific measures undertaken by the National Park Service and the California Department of Parks and Recreation under the proposed action. RNSP employment would be expected to increase by about 17 FTE positions under this alternative.

Eliminating overnight camping at Freshwater Lagoon Spit and limiting vehicle access for commercial fishing at Freshwater Lagoon Spit, Gold Bluffs Beach, and Crescent Beach to only those individuals holding permits issued between March 1996 and September 1, 1999, could result in moderate adverse impacts on visitors and residents in nearby communities, namely, Orick and Klamath. Similarly, prohibiting vehicle access on beaches in RNSP to redwood burl and wood carvers for the purpose of wood gathering could result in adverse impacts on this group, especially people engaged in this activity from Orick. Also, land acquisitions near Redwood Creek for estuarine restoration and/or with scenic or significant resource values could result in adverse impacts on some ranchers and other agricultural workers who reside in the Orick area.

Direct employment and earnings — NPS or CDPR jobs taken by workers (and their earnings) in response to plan-related changes, e.g., the need for more maintenance workers, backcountry rangers, interpretive rangers, etc. Also included in this category are jobs taken by workers (and their related earnings) at local hotels, restaurants, gas stations, etc. because of the increase in demand at such establishments because of increased visitation at Redwood National and State Parks.

Indirect employment and earnings — jobs and related earnings of workers hired to produce goods and services needed to support expanded RNSP operations as a result of implementing the approved joint plan for the parks including contracted services, paper products, computers and other equipment, vehicles, and jobs and related earnings of workers hired to provide goods and services to establishments that provide tourism-related services (e.g., hotels and restaurants, etc.) to RNSP visitors.

Induced employment and earnings — jobs and related earnings of workers hired to produce goods and services needed by direct and indirect workers as a consequence of the respending of direct and indirect earnings in the local economy. Basically, this is the economic effect of household expenditures made by direct and indirect workers. Thus, when new RNSP employees earn money, they spend a portion of it in the local economy and others are hired to provide the goods and services they demand.

Purchases of goods and services locally made by overnight visitors at Freshwater Lagoon Spit would likely decline, although some visitors would seek RV parking at nearby locations, including Orick and Klamath, rather than continuing to locations outside the area. Nonetheless, terminating overnight use at Freshwater Lagoon Spit could result in adverse economic and social impacts on Orick businesses and residents, although the increase in RNSP visitation projected under the proposed action may offset, at least partially, the loss in economic activity from reduced spending by users of Freshwater Lagoon Spit.

According to a survey in August 1996, about 70% to 75% of the campers would stay at a campground in Orick or other locations in the area if overnight camping at Freshwater Lagoon Spit were eliminated; the remainder (25%–30%) would not stop in the area. This would be beneficial for the owners of the nearby campgrounds with unused spaces. The “Affected Environment” part of this document (“Freshwater Lagoon Spit Users” under “RNSP Visitor Use”) contains additional information on visitor use in this area. It is worth noting that the predominant reason for stopping at Freshwater Lagoon Spit was the availability of free camping.

Commercial fishermen (principally for smelt, which are caught along shorelines) would ultimately have no vehicle access as existing permit holders discontinue their activities or fail to renew their permits. The access permits would not be transferable. Thus, after a lengthy period of transition, it is expected that commercial beach fishing at these locations would cease. However, during the transition period it is unlikely that people currently engaged in commercial beach fishing would experience any adverse impacts. Nonetheless, the long-term impacts on the economies and social conditions of several local communities, including Orick's, could be substantial following the termination of vehicle access to the fishing grounds.

Prohibiting vehicle access to RNSP beaches by persons (principally from Orick) engaged in

wood gathering could force redwood burl and wood-carvers to reduce or discontinue their activities, thereby, adversely impacting the local economy. Some of the wood gathering is done by beach fishermen as part of other activities. Also, other means may be available for collecting redwood burls and other wood raw materials. Nonetheless, to the extent that redwood burl and wood carving and related retailing activities are reduced, this would result in substantial adverse economic and social impacts, particularly on Orick businesses and residents.

Some agricultural workers could be impacted if land acquisitions in the Redwood Creek basin floodplain were made by the National Park Service. Owners of the ranches would be compensated, as sales of land would be on a willing-seller, willing-buyer basis, subject to funding authorization. Lessees and employees of the ranches (or portions thereof) acquired by National Park Service, however, could be adversely impacted. Given the proximity of this area to the town of Orick, the loss of agricultural employment could adversely impact economic and social conditions in the community. The impacts would be reduced, however, from temporary new employment opportunities generated by the estuarine restoration projects envisioned by the proposed plan.

Employment losses by some ranchers and other agricultural workers as well as commercial beach fishermen and redwood burl and wood carvers could be mitigated by providing information outreach about prospective NPS/CDPR and other job opportunities to displaced workers.

Population and Housing Impacts

Although most of the employment increases could be filled by the existing workforce, expanded job opportunities would induce modest levels of in-migration to the area. It is likely that most of the in-migrating workers would have skills required for the construction and tourism industries. A few workers would transfer to the area to fill RNSP positions created under the

proposed action. The regional housing market would be modestly stimulated by increased housing demand of RNSP workers as well as by others employed in related activities. There would be no adverse impacts on population and housing in the region.

Public and Commercial Services Impacts

Most municipal services, utilities, and other facilities in both Humboldt and Del Norte Counties and nearby cities (Eureka, Arcata, Trinidad, and Crescent City as well as the McKinleyville, Orick, and Klamath communities) would be unaffected by the proposed action. Transportation infrastructure would not be significantly affected, although traffic on Eureka and Crescent City streets and U.S. Highways 101 and 199 would be expected to increase moderately. There would be no adverse impacts on municipal services or fiscal conditions of local governments in the two-county area. However, eliminating camping at Freshwater Lagoon Spit would slightly reduce the purchases of goods and services in Orick made by such visitors.

Similarly, in the longer term, terminating the vehicle access permits for beach fishermen could result in the loss of economic activity and subsequent deterioration of fiscal conditions in several small communities in the area, including Orick. Prohibiting vehicle access to the RNSP beaches by persons engaged in wood gathering for the redwood burl and the wood carving industry as well as agricultural employment losses due to NPS land acquisitions could result in adverse economic impacts, including worsened local public sector fiscal conditions. This would have an insignificant adverse effect on the fiscal condition of Humboldt County as a whole.

Utility infrastructure would not be adversely impacted. On-site infrastructure within the parks, such as water, sewer, roads, and parking, would be enhanced substantially as part of construction

activities associated with the development of visitor facilities and improved road access.

Services provided by the private sector and used by visitors, such as grocery stores, restaurants, hotels/motels, RV campgrounds, banks, etc., would likely accrue financial benefits from increased tourism generated by the parks, with the possible exception of reduced spending by Freshwater Lagoon Spit RV users and tent campers at Orick businesses. There might be increased private investment in facilities that serve tourists, particularly lodging, restaurants, recreational services, and retail shopping. Mitigation for the loss of visitor business at Orick could include improved signs indicating availability of visitor goods and services; information brochures at information centers indicating the availability of local service providers; and local public agency development (possibly with NPS/state of California support) of a new privately operated RV park and campground on public lands in the immediate vicinity of Orick; etc.

The Yurok Tribe would possibly benefit from developing a lodge facility as part of its economic development strategy in cooperation with the National Park Service and the California Department of Parks and Recreation.

Land Use Impacts

Partial estuarine restoration might result in the acquisition — only on a willing seller basis — of some parcels within the 100-year floodplain of the lower Redwood Creek valley, which could result in the displacement of several ranches and the loss of some agricultural production, although existing land uses would be largely retained in the lower Redwood Creek valley under the proposed action. Land acquisition would be based only on a willing-seller basis, with compensation established through normal market negotiations.

Also under the proposed action (as opportunities arose,) the National Park Service would acquire

additional lands with significant or scenic resource values, such as lands or interests in land in the scenic corridor north of Orick.

Direct impacts on land use could result from possible changes in land use designation or zoning use classification due to land acquisition for resource protection as described in the previous paragraphs. Indirect impacts would include moderate development of tourism-related infrastructure that could be accommodated under existing land use plans and zoning ordinances. The participation in gateway community planning through the provision of technical assistance by RNSP staff would be a beneficial impact.

Impacts on American Indian Tribes

There would be potentially substantial beneficial impacts for American Indian tribes under the proposed action as RNSP staff worked in partnership with the Yurok Tribe and other American Indian tribes in the area as well as other agencies and cultural preservation interest groups related to issues of mutual concern. The cooperation with these groups would emphasize balancing the management of cultural resources with interpretation, education, and visitor use. Cooperative development of a destination resort would bring substantial economic benefits to the Yurok Tribe.

Conclusion

There would be substantial beneficial regional economic effects from increased spending on lodging, transportation, food, fuel, retail goods and services, etc. in the two-county area when compared to the no-action alternative. The economic benefits would be generated from both construction and operation of new facilities and increased visitor use.

Some local groups would be adversely impacted under the proposed action, including businesses and residents who would experience lower sales

of tourism-related goods and services due to reduced purchases by RV users as a result of terminating overnight use of Freshwater Lagoon Spit; commercial fishermen who currently engage in beach fishing at Freshwater Lagoon Spit and Gold Bluffs Beach; redwood burl and wood carvers who would be restricted from gathering redwood raw materials from RNSP beaches; and ranchers and other agricultural workers who would be displaced if land acquisitions in the Redwood Creek basin floodplain were made by the National Park Service. This would be on a willing-seller basis, so impacts would be contingent on landowner agreement to convert the land from agricultural production. A substantial portion of the adverse impacts would likely occur in the Orick area. This could contribute to the deterioration of the economy.

There would be modest increases in population and small beneficial effects on housing. Similarly, there would be no adverse impacts on public services and some modest beneficial impacts on land use planning due to the participation of RNSP staff in gateway community planning. Finally, there would be no adverse impacts on American Indian tribes in the area under the proposed action.

Cumulative Impacts

Future actions unrelated to actions proposed in this joint plan that could have long-term implications for the two-county regional economy include further federally imposed reductions in timber harvests and restrictions on fishing (e.g., further reductions in the salmon fishing quota). Such actions could result in substantial losses of permanent and seasonal employment and earnings and possible out-migration from the area. It is also possible that the state of California will construct a new state prison or expand Pelican Bay State Prison near Crescent City, which would have the opposite effect in terms of stimulating economic activity and improving employment opportunities. The combination of influences on the regional economy from these

actions would likely be neutral to slightly positive in terms of stimulating employment and earnings. The cumulative impacts on the regional economy associated with these other actions, such as the two just mentioned above, would be slightly greater than anticipated for any of the alternatives alone, including alternative 1 (the proposed action).

In regard to **alternative 1**, the addition of improved RNSP facilities and a new destination lodge adjacent to the parks would attract more visitors to the two-county area. Higher visitation and related spending would have a positive impact on regional economic activity. Reducing the amount of timber harvested or the allowable ocean fishing catch, however, could result in the loss of several hundred jobs and related income. Overall, the cumulative impact on employment and personal income would be to modestly increase employment and income above levels anticipated for implementing the proposed action alone. This would lead to insignificant impacts on the region's population base as a result of immigration of households seeking employment opportunities and to moderate and significant housing impacts, especially on rental housing.

The cumulative impacts on communities within the impacted region would be modestly greater than anticipated for the proposed action alone. Higher visitor spending levels and associated tax revenues from retail sales and hotel/motel stays as well as property tax collections from new private facilities would provide modest fiscal benefits to most of the communities.

The Orick community might experience moderate adverse impacts, which would be an exception to the general conditions resulting from the cumulative influences implementing the proposed plan (alternative 1) and other actions not related to the plan. This would depend on

whether commercial beach fishing is ultimately discontinued due to termination of vehicle access permits by the California Department of Parks and Recreation, redwood burl and wood carving activities are curtailed by lack of alternative means of gathering redwood raw materials, and ranching employment declines due to NPS land acquisitions, and the extent of reduced spending by RV users prohibited from staying overnight at Freshwater Lagoon Spit. If the combined impacts from the plan actions (that would potentially result in adverse impacts on the Orick community) are substantial, then offsetting (and positive) economic activity stimulated by the proposed plan actions, e.g., increase in visitation and other actions unrelated to the plan, might not result in changes that are either neutral or positive overall.

Municipal costs would also be greater. There would be minimal cumulative impacts on utilities provided by municipal governments as long as service connections are available at development sites for any new facilities. Most public utilities are funded by user fees, which are direct charges to beneficiaries of these services.

Under **alternative 2** (the no-action alternative), the cumulative impacts of these other actions would be similar to the proposed action; however, the combined effects on the regional economy and population would be only modestly positive. Under **alternative 3** the effects of these other actions would slightly offset the modest adverse impacts on the regional economy associated with this alternative. The cumulative impacts under **alternative 4** would be similar to the proposed action, albeit at a somewhat greater magnitude because there are greater construction and operations impacts under alternative 4. The cumulative impacts on the Orick community would likely be positive under this alternative.

IMPACTS OF IMPLEMENTING ALTERNATIVE 2 — NO ACTION

IMPACTS ON NATURAL RESOURCES

Soils

The continued use, maintenance, and management of RNSP roads, trails, parking and picnic areas, buildings, campgrounds and campsites, and utility systems would result in ongoing minor disturbances to soils and topography, such as erosion and soil compaction. More of the parks' roads would remain unpaved with this alternative (Gold Bluff Beach, Cal-Barrel and Howland Hill roads, Tall Trees access road, and Coastal Drive), causing more erosion and dust dispersion than under alternative 4. Foot traffic would continue to cause compaction and soil loss on established and social trails and near visitor and interpretive facilities.

The construction of additional campgrounds, primitive campsites (not accessible by vehicle), and hiking, equestrian, and mountain biking trails could cause some minor soil disturbance such as soil erosion and increased run-off. Minor soil erosion could occur until vegetation is reestablished in areas disturbed by construction activities. Mitigation measures would be implemented to minimize erosion during construction activities.

Alternative 2 (continuation of the current disturbed lands restoration program) would emphasize partial landform restoration on parklands in the lower Redwood Creek basin and would remove 155 miles of roads, with removal of an average of 2 miles per year over a period of 66 years. Restoration treatments with this alternative would take nearly four times longer to complete than alternatives 1, 3 and 4 (17 years). Roads that pose the greatest threat to resources would be treated first. Minor roads would receive only limited treatment, primarily near streams.

Overall, there would be a major beneficial impact on the biological and physical functioning of the tributaries of lower Redwood

Creek from the treatments proposed under this alternative; however, it would take much longer to realize these benefits than with the other alternatives, and the risk of resource damage would continue in the interim.

Erosion potential would be reduced at stream crossings and along all intervening major road segments through the restoration of landforms, soils, and hydrologic patterns; ecosystem impacts from untreated minor road segments would continue. Long-term protection of downslope and downstream terrestrial, riparian, and aquatic habitats would occur as buried topsoil is recovered and redistributed on the finished surface, helping to reestablish vegetation along the restored roads. Restoring prelogging topography along the treated roads would improve the visual quality of the basin as roads were removed and the area was recontoured and revegetated. However, minor roads receiving only limited, partial treatment, primarily near streams, would continue to disrupt natural hillslope hydrology, and vegetation would recover more slowly because little topsoil would be returned to the surface.

This alternative would have the same long-term beneficial impacts as alternatives 1 and 4. However over the short term, implementing this alternative would be the least protective of downstream and downslope resources of all of the alternatives because watershed restoration would take the longest time to complete. The failure of road benches or stream crossings before completion of the restoration program would be more likely than with the other alternatives because a large damaging storm causing catastrophic damage to downslope and downstream resources could occur over the long period required for restoration to be completed under this alternative.

This alternative would result in the decommissioning of roads upstream of the national park much more slowly — 227 years to treat 911 miles of roads — than with the other alternatives proposed in this joint plan (alternatives 1, 3, and

4 would take 17 years to complete). This alternative would have a minor beneficial impact on aquatic habitats and alluvial redwood groves along the main stem of Redwood Creek upstream and within the national park due to the slow rate of progress, the downstream attenuation of the benefits, and the risk of the catastrophic damage of a large storm before completion of the work. There is also the possibility that road sections that were not identified as having high erosion potential and that were not treated could fail after treatment was completed.

Conclusion

The ongoing use, maintenance, and management of roads, trails, and facilities would cause minor disturbances to soils, such as soil erosion and soil compaction. Minor short-term increased runoff and soil erosion could occur as a result of the construction of additional trails, campgrounds, and campsites. The watershed restoration program would have a major beneficial impact on downslope and downstream terrestrial, riparian, and aquatic habitats in the tributaries of lower Redwood Creek. There would be greater potential for failure of road benches and stream crossings before completion of the watershed restoration program than with the other alternatives because it would take about four times longer to complete the program. Over the long term, alternative 2 would improve the park resources through the elimination of abandoned major roads; the restoration of landforms, soils, vegetation; and the restoration of surface hydrology along major roads on national park lands. However, minor roads that receive only limited, partial treatment, primarily near streams, would continue to disrupt natural hillslope hydrology, and vegetation would recover more slowly because little topsoil would be returned to the surface.

Upstream of the national park, road decommissioning and erosion prevention treatments would have a minor beneficial impact of helping protect aquatic habitats, alluvial and riparian vegetation, and water quality in and along the main stem of

Redwood Creek. However, this alternative is the least protective of the natural resources in Redwood Creek basin over the short term because the restoration program would take longer to complete than with the other alternatives, increasing the probability of a large storm causing major adverse impacts from road and hillslope failures in the basin.

Cumulative Impacts

Over the long term (decades to centuries), watershed restoration treatments on national parklands in lower Redwood Creek basin and cooperative erosion control activities upstream of the national park would have a major beneficial cumulative impact of reducing soil erosion and sedimentation that have been adversely affecting downstream resources such as wildlife, water quality, vegetation (alluvial redwood groves, riparian vegetation, and hillslope forests and prairies), and aquatic habitats in the tributaries and main stem of Redwood Creek.

Water Quality

Land use activities adjacent to and upstream of the parks' boundaries, such as logging, road construction, and grazing, would continue to have a major adverse impact on the water quality in the parks. Point and nonpoint source pollution from disturbed areas (particularly logging roads) would continue to elevate suspended sediments and turbidity in the parks' streams. Disturbed lands restoration of parklands in Redwood Creek basin would have the beneficial impact of reducing nonpoint source pollution.

Water quality degradation in the lower Redwood Creek valley includes elevated levels of nitrogen and phosphorus from agricultural runoff, increased sediment loads from past and current upstream logging activities, and increased water temperatures and decreased oxygen caused by the removal of riparian vegetation. There are no actions proposed that would eliminate contamination from animal wastes, reestablish riparian vegetation, or remove the levees along the river,

so these adverse water quality impacts would continue to occur.

Waste at existing and proposed campgrounds (at state parks, Freshwater Lagoon Spit, and remote campsites) might have a localized adverse impact on water quality if not disposed of properly. Water quality monitoring at campgrounds in the state parks would ensure that if a water quality problem existed it would be promptly taken care of.

Impacts on water quality caused by private land uses would depend on the level of cooperation between private landowners and RNSP staff and the willingness of other agencies to apply their water resources protection programs.

Conclusion

Land use activities adjacent to and upstream of the parks continue to contribute point and nonpoint source pollution, such as turbidity, into RNSP streams. Water quality in the Redwood Creek valley is locally being adversely affected by ranching activities and past and current upstream timber harvesting. Because no actions are proposed to reduce contamination from animal wastes or to reestablish streamside vegetation in the lower Redwood Creek valley, these minor adverse impacts would continue. Waste at RNSP campgrounds could cause water quality problems if not disposed of properly.

Cumulative Impacts

Water quality would continue to be adversely impacted by the retention of the federal flood control levees and the erosion and sedimentation caused by past and current logging activities. But over the long term (decades to centuries), watershed restoration in Redwood Creek basin would have a moderate beneficial cumulative impact on the water quality in lower Redwood Creek and the estuary.

Floodplains

The adverse impacts of the flood control levees (see description in the issues discussion of alternative 1 under "Watershed Management and Restoration in Redwood Creek Estuary" in the "Alternatives, Including the Proposed Action" section and in the "Affected Environment" section of this document) would continue, including altering the physical and biological functioning of the Redwood Creek estuary and adversely impacting water circulation in the estuary and sloughs, reducing deepwater pools, decreasing the extent of wetlands and riparian habitat, deteriorating water quality, degrading juvenile rearing and adult holding habitat for fish, and reducing wildlife and invertebrate abundance and diversity in the lower Redwood Creek valley and estuary (see table 26).

Because the north and south slough channels to the embayment have become filled with sediment and the sloughs are now isolated from the embayment (except where the mouth closes and the water level rises and during extreme high tides), dissolved oxygen has decreased and algal blooms and aquatic vegetation has increased in the sloughs. The reduction of the area of scour of the sandbar at the mouth of the river would continue, as would the lower seepage rates. Also, the decreased extent of tidal influence at the mouth of the river would continue. Retaining the current levee configuration under this alternative would perpetuate and exacerbate these major adverse impacts on the lower Redwood Creek floodplain and estuary.

The levees would continue to protect ranchland, structures, and roads from up to a 100-year frequency flood event.

During summer and fall low-flow periods the embayment closes at the mouth of Redwood Creek, and lands in the estuary are periodically flooded. Flooding can prevent the use of ranch equipment, adversely affect growth of crops in the fields, prohibit use of the fields by ranch animals, and periodically restrict access to private properties on Hufford Road.

TABLE 26: SUMMARY OF MANAGEMENT ACTIONS IN LOWER REDWOOD CREEK AND THEIR IMPACTS ON RIVER MORPHOLOGY, FLOODPLAINS AND THE ESTUARY UNDER ALTERNATIVE 2 (NO-ACTION) AND ALTERNATIVE 4

Management Action	Impact
Retain current extent and configuration of levees along lower Redwood Creek	Would continue major adverse impacts on water circulation and sedimentation patterns (increased sediment deposition in estuary and sloughs, eroded channel, steeper channel gradient, higher stream velocity) and degraded water quality. Beneficial impact of protecting agricultural lands, structures, and roads from winter flooding.
Channel manipulation to protect the Redwood Information Center	Would interfere with natural fluvial processes such as river migration; would ensure that Redwood Information Center would not be destroyed by river migration.
Dredge north and south sloughs	Aggradation and overwash of the sloughs would continue to occur. Turbidity would be temporarily increased. Without partial levee removal, dredging would only be short-term solution because over time the estuary would fill in with sediment.
Elevate Hufford Road	Would ensure access for property owners, eliminate .09 acre of wetland/floodplain, and reduce the likelihood that artificial breaching of sandberm would occur to ensure landowner access.
Watershed restoration activities (disturbed lands restoration throughout parklands in Redwood Creek basin to be completed in 66 years)	Over the long term, decreased upstream erosion and sediment inputs would reduce downstream streambed migration, aggradation, streambank erosion, channel widening, and increase deepwater pools in the river.

Woody debris left in the fields after waters recede can also interfere with cultivation and mowing. Up to 95 acres of agricultural land and portions of Hufford Road could continue to be flooded occasionally during the summer and fall when the sand berm closes the mouth of Redwood Creek. Natural or human-induced uncontrolled breaching of the berm to protect properties from flooding might also still occur without a permit from the Corps and could entrain and kill large numbers of fish in the discharge.

Since the mid-1990s, the park's policy has been to protect salmonid habitat from the adverse effects of an uncontrolled breach. The U.S. Army Corps of Engineers approved a section 404 permit for controlled breaching of the estuary during the summer and fall low-flow periods to protect fish habitat. Controlled breaching by RNSP staff prevents the occurrence of an uncontrolled natural breach that could have major adverse impacts on salmonid habitat. As a condition of the section 404 permit, the Corps stated that a longer term alternative should be

pursued to manage water levels in the estuary. These measures may include the setback of levees, conservation easements, the raising of the county road above flood elevation, or outright land purchase in the lower Redwood Creek valley to protect the fisheries resource.

As long as Redwood Information Center remains in its current location, channel manipulation might at times be necessary to protect the facility through an approved section 404 permit. There still remains the risk of structural damage and loss of life at the Redwood Information Center from a large flood, earthquake, or tsunami.

Ongoing disturbed lands restoration would reduce the amount of sediment entering Redwood Creek and its tributaries and would assist in the recovery of stream morphology, and hydrologic and biological processes. The erosion potential at stream crossings in the national park would be eliminated upon completion of the watershed restoration program, even though the downstream benefits from these treatments might take decades to centuries to be fully realized.

Conclusion

The no-action alternative would continue to have a major adverse impact on the extent of natural floodplain and related processes and on biological and physical processes and aquatic resources in the lower Redwood Creek valley and Redwood Creek estuary. Elevating Hufford Road and retaining the levees would have the beneficial impact of protecting private property and current land uses. Dredging the sloughs would temporarily increase turbidity, but over time the estuary would fill in with sediment.

Cumulative Impacts

Downstream cumulative impacts such as siltation and aggradation, increased bank erosion, and channel widening in Redwood Creek basin streams would continue to occur but would decrease as roads, road benches, and stream crossings were treated through erosion prevention treatments over the long term. Watershed restoration would have a moderate beneficial cumulative impact on physical and biological processes in lower Redwood Creek valley and Redwood Creek estuary. Retention of the levees would continue to have a major adverse impact on sedimentation and other hydrologic processes in the lower Redwood Creek valley and estuary.

Wetlands

Impacts from Watershed Restoration

Watershed restoration under this alternative would have long-term benefits for riverine and perennial wetlands in drainages where landforms were restored and roads removed or treated to reduce erosion. The primary difference between this alternative and the proposed action would be the time period over which watershed restoration occurred. There would be fewer short-term benefits for riverine and perennial wetlands under this alternative because fewer miles of roads would be treated annually, thus increasing the chance that untreated roads would fail before restoration could be completed.

A major storm occurring before completion of all watershed restoration treatments would be likely to adversely affect downstream wetlands by sedimentation that would alter drainage patterns and destroy vegetation and wildlife in and adjacent to the stream channel.

Wetlands along the main channel of Redwood Creek would benefit from increased attention to erosion prevention in lands upstream of the national park. Less sediment would move downstream into the national park. Sediment transported downstream fills in riverine and palustrine wetlands, decreasing their overall size. Wetland functions and values lost to sedimentation include flood attenuation and wildlife habitat. If sediment was transported from upstream of the park into Redwood Creek, it would eventually move down the creek into the estuary, where estuarine functions would be impaired.

Impacts of Estuary Restoration

Under the no-action alternative, there would be no restoration of the estimated 75% of estuarine wetland habitat in the Redwood Creek estuary that has been lost through channelization, draining, diking, and infilling of the estuary and sloughs. Because the flood control levees would not be removed under this alternative, and no wetlands would be restored as a direct result of partial levee removal, reduction in flow and circulation from the levees combined with delivery of high volumes of sediment from industrial activities upstream would continue to reduce the depth of portions of the estuary. The alteration of estuary circulation and flow that began when portions of the estuary were diked and drained for residential and agricultural development and when the flood control levees were constructed in 1968 would continue. These are considered indirect adverse impacts on those areas of the estuary that are defined as wetlands.

Long-term adverse impacts from habitat reduction and alteration of food sources of anadromous salmonids that use the estuary at some stage in their life cycle would continue. Habitat for the tidewater goby would continue to be less

than under original estuary configuration and circulation patterns. Occasional severe adverse impacts on fish would result if illegal uncontrolled breaching occurs during the summer. These are indirect adverse impacts on wetlands because fish habitat is one of the major functions and values of the Redwood Creek estuary.

Impacts of Second-Growth Forest Management

There are 7,900 acres of second-growth forest within 300 feet of intermittent and perennial stream channels, none of which would be managed under this alternative. There would be no direct short-term or long-term adverse impacts on these wetlands from managing this second-growth forest. There would be minor indirect adverse impacts on wetlands from altered vegetation patterns and species composition in the unmanaged second-growth forests upslope of and adjacent to stream channels and drainages.

Impacts Related to Artificial Impoundments

Artificial impoundments at Marshall Pond and Lagoon Creek include shoreline areas that meet both the NPS and Army Corps of Engineer criteria for wetlands. Should an evaluation of physical condition of these dams result in a *determination that either dam constitutes a significant threat to public safety or resources*, RNSP staff would compare the risk posed by failure of the dam with the beneficial wetland values to determine whether the risk to public safety outweighs the beneficial functions and values of the wetland. If public safety was determined to be the paramount value, and removal of either dam was proposed, replacement of lost equivalent wetlands would be required for mitigation.

Wetland values of Marshall Pond include habitat for fish, amphibians, breeding waterfowl, and other wildlife, and recreational and aesthetic benefit to hikers passing the pond on the Flint Ridge portion of the Coastal Trail. Mitigation for removing Marshall Pond would include restoring and recontouring the natural stream channel,

which would continue to provide habitat for amphibians and fish. Removing the dam and restoring a natural stream channel would increase the amount of salmonid spawning habitat in Richardson Creek. This would be an indirect benefit for wetlands from restoring wetland functions of fish and amphibian habitat.

Beneficial wetland values of Lagoon Creek include aesthetics, recreation, and wildlife habitat. These values would be considered, and mitigation to replace these values would be developed should the dam fail or otherwise become a threat to public safety or significant resources.

Impacts Related to Visitor Use

Minor adverse impacts on wetlands would result from construction, use, and maintenance of trails, camping areas, and public roads. There would be fewer impacts from construction, use, and maintenance of camping areas than from trails because more new trails would be constructed than new camping areas.

There would be direct adverse impacts on coastal streams that drain into the ocean at Gold Bluffs Beach if vehicles continue to drive through this area to reach Fern Canyon. These impacts would be anticipated to be short term because winter storms and seasonally high tides, in combination with heavy rainfall and subsequent high creek and stream flows, erase traces of vehicle use. There would be direct, short-term, repeated adverse impacts on about 900 square feet of riverine wetland near the Fern Canyon parking area from annual maintenance and from vehicles driving through the streams on the approach to the parking area. Relocating the parking area would result in the restoration of about 20,000 square feet of wetland.

Retaining the road, parking, and restrooms at Crescent Beach picnic area would result in continued impacts on 0.5 acre of coastal palustrine wetland.

Impacts of Operations (Maintenance)

Road maintenance including culvert replacement and ditch-cleaning would have minor adverse impacts on small wetlands along all public roads and some former logging roads that are being retained for RNSP administrative access. Long-term adverse impacts on adjacent drainages would continue as sections of roads fail, with subsequent runoff into and sedimentation of stream channels. A major road failure would result in moderate to significant short-term adverse impacts from erosion and runoff, depending on the location of the failure.

Minor long-term adverse impacts into nearby streams from runoff of petroleum products and from road repairs and maintenance would continue on Del Norte Coast Redwoods State Park entrance road, Cal-Barrel Road, Howland Hill Road, and the Tall Trees access road.

Minor adverse impacts on coastal drainages from erosion and runoff from the unsurfaced portions of the Coastal Drive would continue. The removal of the Coastal Drive and reconstruction as a trail would result in short-term adverse impacts on small isolated wetlands and headwater stream channels. Minor impacts from erosion of bare soils following road removal and restoration would continue for one season until revegetation occurred. Long-term beneficial impacts on riverine wetlands in coastal drainages would result from restoring the original landforms and stream channels if the road were removed and rebuilt as a trail.

Conclusions

There would be major long-term benefits for intermittent and perennial stream channels immediately downstream from those areas where original landforms were completely restored. There would be a moderate long-term benefit for stream channels immediately downstream of areas where roads were decommissioned or treated to control erosion. Other downstream wetlands would benefit indirectly from restoring natural drainage patterns and reducing sediment

delivered into streams. Untreated sites would continue to fail, delivering sediment into Redwood Creek and thus causing adverse impacts on riverine palustrine wetlands.

The no-action alternative would result in little or no increase in the amount of wetlands associated with the Redwood Creek estuary. Channel dynamics and circulation patterns would continue to be adversely affected by retaining the configuration and drainage structures of the levees.

About 10 to 15 acres of forested pond and marsh habitat favored by some waterfowl species would be lost with removal of Marshall Pond (5 to 10 acres) and Lagoon Creek (about 5 acres). There is relatively little forested pond habitat in the parks. Open water marsh and pond habitats exist in the coastal lagoons and the Crescent Beach ponds. The coastal lagoons are primarily open water habitat. The Crescent Beach ponds are preferred by coastal bird species. Birds that use Lagoon Creek are commonly observed in other nearby habitats. Birdwatchers would lose a unique site in the parks with the removal of Marshall Pond, which would be considered an indirect adverse impact on the recreational and aesthetic values of this wetland.

The removal of the dams and the restoration of the stream channels at Marshall Pond and Lagoon Creek would adversely affect waterfowl but would increase habitat for fish.

Cumulative Impacts

The overall cumulative impact on wetlands from all actions under the no-action alternative would be a moderate benefit obtained primarily from watershed restoration in the Redwood Creek basin.

This alternative would have moderate long-term adverse cumulative impacts on the wetlands associated with the estuary because little restoration would occur, but there would be a gradual reduction in sediment delivered from road failures upstream in the Redwood Creek basin within and outside the parks.

Very minor indirect but cumulative long-term negative impacts on wetlands associated with intermittent and perennial stream channels would result from allowing second-growth forests to mature without management or intervention and from limiting fire management primarily to prairies. The cumulative impact results from perpetuating unnatural drainage and vegetation patterns.

There would be minor negative cumulative effects on wetlands adjacent to roads from continued road maintenance and erosion into stream channels.

Threatened and Endangered Species

Impacts of Watershed Restoration

Watershed restoration under this alternative would have a greater potential for adverse impacts on coho salmon and other anadromous fish than under the proposed action because it would take about four times longer to complete restoration treatments, thus increasing the chance that untreated roads would fail if a major storm occurred. Long-term benefits for coho salmon and other anadromous fish would be the same as under the proposed action provided that important fish-bearing tributaries received the most extensive restoration treatments and were treated first. The benefits to northern spotted owls and marbled murrelets from watershed restoration would be about the same as under the proposed action.

Impacts of Estuary Restoration

Under this alternative, direct adverse impacts on juvenile coho salmon and other anadromous fish, and on tidewater goby habitat from breaching of the sandberm at the Redwood Creek estuary would be minimized to the greatest extent possible by controlling the timing, depth, and location of breaching when trying to prevent the negative effects of a natural uncontrolled breaching event.

The greatest potential for significant direct adverse impacts on coho salmon and other anadromous fish in the Redwood Creek estuary would exist in the summer when juvenile salmonids are present and the berm is breached in an uncontrolled manner to protect private property from flooding. Direct adverse impacts on juvenile salmonids result from fish being entrained in the outflow of estuarine waters into the ocean, where smaller fish are less able to escape predators. The later in the season breaching is performed, the less adverse the impact, because juveniles are larger and have had more time to adjust physiologically for the transition from fresh water to salt water.

Impacts of Second-Growth Forest Management

Continued indirect long-term adverse impacts on marbled murrelet populations would be anticipated from allowing the approximately 45,000 acres of second-growth forests to mature without treatment because suitable nesting habitat would remain limited to the approximately 43,000 acres that now exist in the parks. Fewer indirect long-term adverse impacts would be anticipated on northern spotted owls than on marbled murrelets from allowing second-growth forest to mature without management because owls will nest in younger forests without the habitat characteristics present only in old-growth stands that murrelets prefer for nesting.

Although second-growth forest stands might attain characteristics suitable for nesting for northern spotted owls in as little as 50 to 100 years and marginally suitable for marbled murrelets in 100 to 200 years (Ralph et al. 1995a), estimates of time required for forests to regain old-growth characteristics without treatment or manipulation may be on the order of 500 years (NPS 1975).

It is not known whether some second-growth stands with extremely dense stocking rates, stands of exotic conifers, or even-aged monocultures would attain suitable characteristics for marbled murrelet nesting in 200 years in the absence of management or intervention.

The 200-year estimate is based on forest stands regrowing in the midst of naturally occurring forest that is colonized by murrelets from adjacent forest with mixed species and age classes and appropriate canopy structure. Reattaining forest characteristics required by murrelets for successful nesting, particularly in second-growth stands that are dense monocultures, may require even longer.

Fragmentation of existing forest in the RNSP ecosystem would continue to have moderate indirect long-term adverse effects on owls and murrelets from edge effects that increase the likelihood of nest predators locating owl or murrelet nests in adjacent old-growth forest.

There would be no direct short-term adverse impacts on murrelets or owls from noise and disturbance required to remove selected trees in second-growth forest lands.

Impacts of Prairie Restoration

Prairie restoration in the Bald Hills would result in minor direct short-term adverse impacts on nesting spotted owls and murrelets if smoke from prescribed fires drifted into nesting territories or occupied stands.

The removal of Douglas-fir greater than 18 inches diameter at breast height or greater than 40 years of age for the restoration of Bald Hills prairies might result in minor adverse impacts on northern spotted owls from removing potential nesting habitat. The impact would not be significant because of the amount of better habitat available in the forests adjacent to the prairies. Direct adverse impacts on owls would be avoided through the survey of conifers to be removed. If owls were found to have established territories in or adjacent to the trees, the trees would not be cut.

Adverse impacts on marbled murrelets from drifting smoke and disturbance from prescribed fires would be avoided by conducting these burns outside the restriction period established to protect nesting murrelets or through other

methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service. Adverse impacts on owls would be reduced by complying with the air quality standards set by the regional air quality control board to reduce adverse effects of drifting smoke.

Restoring natural ecological processes including fire would result in indirect long-term benefits for all listed or proposed threatened or endangered species that inhabit RNSP ecosystems.

Impacts Relating to Fire Management

Impacts would be the same as those described under "Impacts of Actions That Are Common to All Alternatives."

Impacts Relating to Artificial Impoundments

There would be minor adverse impacts on coho salmon and other anadromous fish if the dam at Marshall Pond was retained, which would reduce the available spawning habitat in about 1,500 feet of the original stream channel of Richardson Creek. There would be a temporary adverse impacts on coho salmon and other anadromous fish from catastrophic failure of the Marshall Pond dam. Fish might be forced prematurely into the Klamath River if hydraulic pressure after catastrophic dam failure was great enough to flush the impounded water into the river. The removal of the dam and the restoration of the stream channel to its original contours would directly benefit coho salmon and other anadromous fish.

There is no information on whether the original stream channel at Lagoon Creek was occupied by coho salmon or other anadromous fish. If there was suitable habitat, it was likely occupied by steelhead, coastal cutthroat trout, and coho salmon. A long-term minor benefit to these fish populations would be anticipated if the stream was restored following the removal of the impoundment.

Impacts Related to Visitor Use

Long-term noise of variable intensity includes noise from highways and from developed areas and temporary noise from the construction of trails and the maintenance of facilities. Trucks braking on steep hills, such as Bald Hills Road near Lady Bird Johnson Grove, make short-term, intense noise repeated several times daily. Moderate-term noise would include RNSP resource management actions, including watershed restoration and second-growth forest management. Noise impacts could be mitigated by (1) conducting activities outside the breeding season, (2) by restricting the noise to very short periods in the middle of the day, (3) by surveying for the presence of birds and not conducting management activities if nesting birds were present, or by (4) other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

Impacts on marbled murrelets, northern spotted owls, and snowy plover habitat that result from campgrounds accessible by vehicles include noise from people, vehicles, and generators; garbage generation, which attracts nest predators and may contribute to an increase in abundance and distribution over naturally occurring levels of these predators; and the development of support infrastructure, including roads and utilities, with increased maintenance required.

There would be minor, temporary adverse impacts on marbled murrelets and northern spotted owls from noise and disturbance in old-growth campgrounds in the three state parks. These impacts have occurred for many years. The breeding season for both birds begins one to two months before the heavy visitor use season. Birds that initiated nesting before increased visitor use of the campgrounds could be disturbed as noise and use increases. This is not considered likely because there is minor noise and disturbance from visitor, maintenance, or residential use of the campgrounds year-round.

The construction of more campsites in vehicle-accessible campgrounds would increase visitor

use in old-growth redwood and Douglas-fir forest in Jedediah Smith Redwoods State Park; in old-growth redwood, prairie, and riparian forest in Elk Prairie campground in Prairie Creek Redwoods State Park; in red alder riparian forest in Mill Creek campground in Del Norte Coast Redwoods State Park; and in coastal dune habitat in Gold Bluffs Beach campground in Prairie Creek Redwoods State Park. Adverse impacts on northern spotted owls and marbled murrelets would be minimized by selecting sites in habitats least suitable to these species in the forest campgrounds. The construction of new campsites in existing old-growth campgrounds would have a minor, incremental effect on the birds from slight increases in noise and disturbance during the high visitor use season. The construction of more campsites at Gold Bluffs Beach would not be anticipated to result in new adverse impacts on snowy plover habitat because the amount of human use in the immediate vicinity of the campground makes it generally unsuitable for plover nesting.

The construction of new campsites in the forest campgrounds would constitute an adverse impact on marbled murrelets, marbled murrelet critical habitat, and northern spotted owls; but the amount of habitat affected would be very small and is already affected by ongoing use of the campgrounds. Acreages of suitable murrelet and owl nesting habitat within each campground and associated developed area, and within 0.25 mile of each campground and developed area, are approximately 83 and 431 acres at Jedediah Smith and 37 and 326 acres at Elk Prairie campground, respectively. At Mill Creek campground there are about 62 acres of development within suitable owl nesting habitat and 493 acres of spotted owl nesting habitat would be affected. There is no development in suitable murrelet nesting habitat, but about 14 acres of suitable murrelet nesting habitat within 0.25 mile of the campground would be affected by maintenance activities. At Gold Bluffs Beach campground, there are about 80 acres of suitable murrelet and owl nesting habitat within 0.25 mile that might be affected by noise.

The overall level of development and use is significantly lower in primitive camping areas compared to drive-in campgrounds. There are no primitive camps that have been developed in suitable northern spotted owl or marbled murrelet nesting habitat. The number of acres of suitable owl and murrelet nesting habitat within the parks that would be affected by maintenance of primitive camps, and therefore subject to noise effects, would be about 1.2 acres at DeMartin; 8 acres at Flint Ridge; 37 acres at Butler Creek; 79 acres at Miner's Ridge; 33 acres at Forty-four Creek; and 101 acres at Elam Creek.

Trails and roads are linear features that create noise and disturbance within a narrow corridor. Currently, 54% of old-growth forest (22,540 acres) in the parks is within 0.25 mile of trails. The construction of the East Side Trail along the east side of the Redwood Creek basin between Highway 101 and the Tall Trees Grove, plus the Skunk Cabbage Groves Trail on the hill southwest of Davison Ranch, would result in 60% of old-growth (24,530 acres) being located within 0.25 mile of trails. The construction of all trails included in approved RNSP planning documents would result in 69% of old growth (28,200 acres) being within 0.25 mile of a trail.

There would be minor to moderate repeated adverse impacts from continuing noise and disturbance from vehicles on Highways 101, 199, and 197, the Newton B. Drury Scenic Parkway, Bald Hills Road, Cal-Barrel, Howland Hill, and Coastal Drive Roads that pass through old-growth forests. The use of most RNSP roads in old-growth forest other than the major highways is occasional and short term and would result in minor adverse impacts.

Impacts of Visitor Access and Circulation

The impacts on threatened and endangered species from proposals related to visitor access and circulation are similar to those described under "Impacts from Visitor Use." These impacts are primarily on birds that inhabit areas near road corridors and result from noise and disturbance due to road maintenance and from

traffic on the roads. The impacts on threatened and endangered species from proposals relating to visitor access and circulation would be the same as the impacts from general development, general facility maintenance, or visitor use of highways. The degree of impact varies with the location of the road, because the roads pass through different habitats of varying quality.

Vehicle traffic on roads and highways and maintenance of these facilities results in variable noise levels. Trucks braking on steep hills, such as Bald Hills Road near Lady Birds Johnson Grove, make short-term, intense noise that is repeated daily. There would be minor to moderate repeated adverse impacts from continuing noise and disturbance from vehicles on those roads that pass through old-growth forest and have the most use (Bald Hills, Newton B. Drury Scenic Parkway, Howland Hill Road). The use of the other roads in old-growth forest is occasional and short term and would result in minor adverse impacts.

Noise impacts due to maintenance of roads could be mitigated by (1) conducting the activities outside the breeding season, (2) restricting the noise to very short periods in the middle of the day, (3) surveying for the presence of birds and not conducting maintenance activities if nesting birds were present, or (4) other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service.

Impacts on northern spotted owls and marbled murrelets would be least likely to result from maintenance or use of the Davison Road-Gold Bluffs Beach Road along the beach and portions of the Tall Trees Grove access road, because large sections of these roads are not in old-growth forest habitat suitable for owls or murrelets.

Conclusion

Watershed restoration in the Redwood Creek basin under the no-action alternative would have a moderate positive long-term effect on coho salmon and other anadromous fish spawning

ENVIRONMENTAL CONSEQUENCES

habitat and indirect minor positive impact on tidewater goby habitat downstream in the Redwood Creek estuary.

Implementing this alternative would result in a continuing major direct adverse impact on tidewater goby habitat and a moderate adverse impact on coho salmon and other anadromous fish occupying the Redwood Creek estuary from habitat destruction and the channel alteration due to levees, along with continued sedimentation from upstream land uses outside the national park.

Breaching of the sandberm at the Redwood Creek estuary results in a minor indirect adverse impact on snowy plovers from a decrease in available nesting habitat.

Impacts from visitor use of the parks, including recreational use of roads, trails, and campgrounds, would affect primarily northern spotted owls and marbled murrelets occupying old-growth forests. There would be minor indirect adverse impacts on snowy plovers from visitor use of sandy beaches that constitute their nesting habitat. Visitor-related impacts would be minor to moderate, depending on the season. There would be moderate adverse impacts from visitor use from noise and disturbance during the nesting season in those areas known to be occupied by owls or murrelets.

There would be very minor adverse impacts on marbled murrelets and northern spotted owls from the removal of hazard trees in campgrounds because neither owls nor murrelets are known to occupy trees in campgrounds in old-growth habitat. Any impact from hazard tree removal would be a minor cumulative impact from removing potential nesting habitat.

The primary adverse impacts on owls and murrelets from RNSP operations under the no-action alternative would result from the construction and maintenance of visitor and administrative facilities in old-growth forests. Most new construction is anticipated to be for new trails. These impacts would range from

minor to moderate, depending on the specific location and timing of the construction and maintenance required.

Cumulative Impacts on Threatened and Endangered Species

The overall cumulative impact on threatened and endangered species under the no-action alternative would be anticipated to be a moderate positive long-term benefit, obtained primarily from watershed restoration.

Continuation of the current management of the Redwood Creek estuary would have minor cumulative adverse impacts on tidewater goby habitat.

Allowing second-growth forests to mature without management or intervention would slow reattainment of old-growth habitat characteristics in these forests, thus delaying the suitability of these second-growth forests for murrelet and owl nesting. Forest fragmentation would be reduced with or without treatment, but it might take as long as 500 years without management. The reduction of fragmentation would be a moderate, very long-term cumulative benefit for marbled murrelets and northern spotted owls.

The removal of abandoned logging roads and subsequent landscape restoration would result in a long-term benefit for marbled murrelets and northern spotted owls because restoration would decrease fragmentation of forests. About 60 miles of trail would be constructed throughout the Redwood Creek basin, increasing human activity that can attract predators of the bird nestlings. There would be a net gain of habitat within the parks from decreased fragmentation of forest from regrowth following watershed restoration.

Visitor use of the parks, including recreational uses and RNSP operations (construction and use of facilities and all maintenance activities in the parks) would have moderate cumulative adverse impacts on threatened and endangered species.

The retention of dams and impounded water would have minor adverse cumulative impacts on coho salmon and other anadromous fish populations. The removal of the dams and the restoration of stream channels would have minor cumulative benefits for coho salmon and other anadromous fish populations.

Continuing the prescribed fire program would have a positive cumulative effect on threatened and endangered species.

IMPACTS ON CULTURAL RESOURCES

New facilities (trails and state park campgrounds) would be sited to avoid adversely impacting known cultural resources. Sensitive cultural resources would continue to be susceptible to damage from visitor use.

Implementing the no-action alternative would not improve the RNSP curatorial program. The parks' collection storage would continue to be inadequate, minimal resources would be available for processing archival materials, and computer-based access to the collections would be minimal.

Conclusion

The no-action alternative would provide the least integrated and balanced approach to the parks' management of cultural resources, visitor use, and interpretation. Adverse impacts on cultural resources could result from constructing a primary visitor center outside of the parks, the continued susceptibility of sensitive resources to visitor use, and the inadequacy of the parks' curatorial program.

Cumulative Impacts

Cumulative impacts would result from the continued visitor use of campsites and hiking, equestrian, and mountain bike trails in the

vicinity of sensitive cultural resources, as well as inadequate storage for the parks' collections. It is possible that cultural resources outside of RNSP boundaries have been destroyed or damaged in the past by either nonfederal or nonstate actions. Most actions proposed in this joint plan fall under the auspices of federal preservation laws, as well as the California Environmental Quality Act, which provide legal protection for cultural resources. However, actions occurring outside of the parks' boundaries, such as watershed restoration or the construction of a nonfederally funded visitor center, could adversely impact cultural resources not afforded the protection of federal or state law.

Cumulatively, cultural resources would benefit from the assistance that could be provided to protect cultural resources affected by actions occurring outside of the parks' boundaries, such as watershed restoration and the construction of a nonfederally funded visitor center.

IMPACTS ON VISUAL QUALITY

Due to the inherent visual sensitivity of landforms and land cover within this region, watershed restoration actions under this alternative could result in appreciable impacts on visual resources. These impacts would be most visible on forested and open hillsides as well as open flat areas. Disturbed lands restoration activities altering terrain or vegetation could impact the line, form, color, texture, and visual density of the landscape. Impacts would affect visual experiences in both micro and macro landscapes. The watershed restoration activities specified in this alternative would have primarily short-term negative visual impacts ultimately resulting in long-term benefits. The potential failure of partially treated roads would create unnatural openings. The road benches would remain as visual scars on a macro and micro landscape level. As surrounding second-growth forest matures, the physical delineations of the remaining roads might become increasingly visible through the forest. This impact would be

most apparent from overlooks along the Bald Hills Road and from the 101 Bypass.

Within visually sensitive areas, management actions intended to remove recent signs of human occupation and to restore historic prairie fire regimes could result in short-term negative visual impacts that could affect large viewing areas. Overall, visual quality would greatly depend on project-specific visual analysis and treatment recommended.

Retaining access roads, parking areas, trails, and associated facilities in visually sensitive areas could result in long-term negative visual impacts affecting both micro and macro landscape experiences. Providing additional hiking, equestrian, and mountain biking trails as well as camping facilities would have a beneficial impact on long-term landscape viewing experiences. Retaining existing pullouts, waysides, and views would provide no appreciable increase in macro landscape viewing opportunities. Overall visual quality would greatly depend on project-specific visual analysis of all actions resulting in the removal, relocation, or installation of visitor use and interpretive facilities.

Coastlines and coastal environments are highly sensitive visual resources due to intensive dynamic contrasts and extensive viewsheds. Extensive overnight vehicle camping activities along this highway corridor and adjacent beachfront at Freshwater Lagoon Spit result in overwhelming visual contrasts that strongly impact the indigenous landscape character. Limiting overnight vehicle camping to a single row along the highway, allowing tent camping on the south end of the beach, and providing portable toilets at several points along the beachfront would continue to result in major negative visual impacts affecting much of the area's natural character.

Acquisition related to viewshed protection and lands with significant scenic value would greatly enhance the preservation of regional landscape character. Identifying and protecting visual/scenic resources along highway corridors and

roads could result in substantial long-term visual benefits. Negative visual impacts resulting from new road development or road maintenance activities should be relatively minor in this alternative.

Conclusion

Under this alternative there would be moderate negative impacts on visual and scenic resources. Most long-term negative impacts would be associated with retaining current visitor impact levels, retaining facilities in visually sensitive areas, and allowing restricted vehicle camping in coastline areas. Other negative impacts would be short term and ultimately would result in long-term visual benefits. Overall visual and scenic quality would directly depend on project-specific visual analysis studies and design implementation. Harvested areas in Redwood Creek basin would be restored first and over time, the lower basin would become more aesthetically pleasing and have a more natural appearance for park visitors. Revegetation of the area would occur soon after restoration activities were completed, but restoration of the visual appearance of an old-growth redwood forest would take decades or more to occur, a minor beneficial impact. Viewshed protection actions would enhance landscape character and result in major long-term visual and scenic benefits.

Cumulative Impacts

Cumulative visual and scenic impacts would include those previously occurring within and surrounding RNSP properties as well as those identified under this alternative. Previous land use activities have impacted the indigenous visual character of virtually all landscape units. The major cumulative visual impacts of the extensive timber harvesting, road and highway alignments, and other development activities would remain highly visible throughout the region. Under this alternative retaining current visitor impact levels, retaining facilities in visually sensitive areas, and allowing restricted vehicle camping in coastline areas would have a major cumulative long-term negative impact on

visual and scenic resources. Watershed restoration activities and watershed protection actions would have a cumulative long-term beneficial impact on visual and scenic resources.

IMPACTS ON VISITOR ACCESS AND CIRCULATION

Not repairing the Coastal Drive and making it a trail if the road failed would eliminate vehicle access to portions of the coast south of the Klamath River and connections to Newton B. Drury Scenic Parkway and would eliminate one access to Alder Camp.

There would be no new developments proposed under existing plans, and the maintenance of the orientation/information centers would result in no new impacts in circulation on the highways or road system.

IMPACTS ON THE QUALITY OF THE VISITOR EXPERIENCE

Visitor Use Opportunities

Under this alternative visitors would benefit from an increase in visitor use facilities and opportunities as current management plans — the *State Redwoods Parks General Plan* and the *1984 Redwood National Park Backcountry Trails Plan* — were implemented. Additional campsites in the state parks' campgrounds would mean more camping opportunities within the parks during the summer when these campgrounds operate at capacity. The greater density of campers during peak season would mean increased noise and competition for campground facilities, and greater demand and stress on activity sites in or adjacent to the campgrounds. Visitors seeking a more primitive camping experience would benefit from the small increase in the number of primitive campsites in the parks.

The additional trails constructed under this alternative would provide more recreational hiking and biking opportunities. These trails would increase the range of trail opportunities and the number of resource areas available for visitors to experience and enjoy. Increasing the number of trails might tend to disperse trail use and visitor impacts on any given trail.

There would be no change in the visitor use opportunities and visitor experience of Freshwater Lagoon Spit, where recreational vehicle campers would continue to be limited to a single row along the shoulder of U.S. Highway 101 and tent camping would continue to be allowed on the south end of the beach.

Visitors would no longer be able to drive their vehicles on Freshwater Lagoon Spit or Crescent Beach. The positive benefit of this action would be that beach users would see and have to deal with fewer vehicles on those beaches (commercial fishermen would still be allowed vehicular access to the beaches). Failure of the Coastal Drive would result in the loss of a driving opportunity, but would result in an additional trail. Visitors would lose some recreational opportunities, mainly fishing and wildlife viewing, if artificial impoundments were removed.

Newton B. Drury Scenic Parkway would continue as a through road, allowing some local casual and commuter traffic to mix with park-specific traffic, making the road more congested and less parklike than if the road was closed to through traffic.

Orientation, Information, and Interpretation

Visitors would receive better orientation services as interpretive waysides, directional signs, bulletin boards, and orientation kiosks were upgraded. Visitors' understanding and appreciation of the parks' natural and cultural resources would be improved as facilities were upgraded to provide more interpretation.

A new primary visitor center, if built, would provide visitors with opportunities to learn about the parks' significant resources and related primary interpretive themes at a much more comprehensive level than the introductory information currently available at the parks' visitor facilities. The use of a variety of interpretive media would lessen visitors' dependence on direct interaction with trained interpretive staff to provide in-depth interpretation and would accommodate the different learning styles and preferences of individual visitors. The location outside the parks might not provide the kind of direct connection between the interpretive messages and the resources being interpreted that a site inside the parks would provide.

Visitors would benefit from additional interpretation of sensitive resource sites through publications and interpretive programs. The improvements in interpretive opportunities in the Bald Hills area would increase visitors' awareness and appreciation for cultural and natural resources there. Expanding the use of the outdoor schools to allow use by community and education groups in the summer and winter would increase the educational opportunities in the parks. Expansion of the education program would allow the program to benefit more students.

Conclusions

Visitors would have a limited number of additional recreational opportunities, and their ability to use and enjoy and experience RNSP resources would be slightly enhanced. Visitors would receive more orientation and interpretive information than at present. Opportunities for camping and trail activities would expand.

Cumulative Impacts

This alternative would have a small positive impact on visitor use and a moderate positive impact on orientation and interpretation.

SOCIOECONOMIC IMPACTS

Readers may want to refer to the "Socio-economic Impacts" section of alternative 1 and/or the glossary where some of the terms used in the following section are defined.

Visitor Use Impacts

The limited improvements envisioned under the no-action alternative would not be expected to attract substantial numbers of new visitors to Redwood National and State Parks beyond historical levels and growth rates indicated by NPS and CDPR visitation reports. The historical growth trend for RNSP visitation discussed in the "Affected Environment" section provides the basis for projecting RNSP visitors under the no-action alternative. The long-run trend line implied an average annual rate of growth (AARG) of 2.5% during the period 1970-96 in regard to the NPS visitation data and an average annual rate of growth of 1.8% during 1990-96 with respect to CDPR overnight camping visitors. Extending the trend line and growth rates through the year 2016 (the study time horizon), it is possible to forecast the number of park visitors during the next 20 years under the no-action alternative. This is done in five-year intervals in table 27.

TABLE 27: PROJECTED VISITOR USE, ALTERNATIVE 2

Year	RNSP-Related Visits NPS Data ^a	Camping Visitors CDPR Data ^b	Total Visits
2001	543,072	158,529	701,601
2006	614,432	173,319	787,751
2011	695,168	189,490	884,658
2016	786,513	207,169	993,682

a. Based on 480,000 visitors in 1996 and future growth of 2.5% per year.
 b. Based on 145,000 visitors in 1996 and future growth of 1.8% per year.

Regional Economic Impacts

The no-action alternative would have a moderate beneficial impact on employment, earnings, and output. The tourism sector would experience healthy long-term growth, following historical patterns. Visitor interest would continue to be concentrated on the highway corridors, information centers, Lady Bird Johnson Grove, Redwood Creek, and roadside campgrounds (mostly in the state parks), as well as RV camping at Freshwater Lagoon Spit.

For the no-action alternative and each of the action alternatives an analysis was made of economic impacts on the region. The details of these analyses are provided in a separate paper entitled "RNSP — Regional Economic Impact Analysis" (Hansen 1999). There would be relatively modest facility construction under the no-action alternative; however, campground development would be extensive (four new campgrounds with 400 campsites would be developed).

Construction activities under alternative 2 would have a total construction cost of \$10.7 million (in 1998 dollars). Because these facilities would be funded from special authorizations, through Congress or the state, the parks' budgets would not be affected and incremental changes in regional economic activity would be generated. Construction would generate about 119 direct and 230 total jobs with estimated direct and total earnings of \$3.8 million and \$7.7 million,

respectively, in 1991 dollars. It is likely that a substantial portion of the jobs and earnings would go to local workers. The impacts from construction activities would be short term, occurring only during the construction period.

RNSP operations would be expected to increase from current levels by about 10 full-time equivalent (FTE) positions (including both NPS and CDPR staffing levels), and operating budgets would increase by about \$1.0 million per year. Visitor use at the parks would be expected to increase under the no-action alternative. The methods for estimating the regional economic impacts associated with RNSP operations and visitor activities were described in the "Socio-economic Impacts" section for alternative 1 (the proposed action). Also, refer to the separate paper "RNSP — Regional Economic Impact Analysis" (Hansen 1999) for additional details.

There would be enhanced employment and income-generating opportunities associated with RNSP operations under alternative 2. With RNSP operations expenditures increasing modestly above current (FY 1996 levels), and RNSP-related annual visitation projected at 787,751 visitors in the year 2006, the associated direct and total (including indirect and induced components) employment would amount to 1,269 workers and 2,413 workers, respectively, due to RNSP purchases for personnel and other goods and services as well as visitor spending within the two-county region. (Direct and total employment associated with RNSP operations and visitor use during the 1996 base year

amounted to 941 workers and 1,841 workers, respectively.)

Earnings associated with direct employment would amount to \$21.3 million; and total earnings would be \$56.7 million in 1991 dollars. These measures of economic activity would be associated with \$41.6 million in direct purchases and \$97.4 million in gross output within the region, also in 1991 dollars. It is necessary to recognize, however, that the additional regional economic activity associated with increased visitor use and associated expenditures beyond baseline levels is largely an artifact of expansion of recreation/tourism in general, not the result of specific measures undertaken by the National Park Service or California Department of Parks and Recreation under the no-action alternative. In effect, the increase in tourism is driven by national economic and demographic conditions and visitation trends.

Allowing commercial beach fishing to continue at Freshwater Lagoon Spit, Gold Bluffs Beach, and Crescent Beach by permit only would result in no impacts on the affected population groups within the region.

Population and Housing Impacts

Most of the employment increases under the no-action alternative could be absorbed by the existing workforce. A few people might be induced to in-migrate to the area for work opportunities. There would be no adverse population and housing impacts on the region.

Public and Commercial Services Impacts

Most municipal services, utilities, and other facilities in Humboldt and Del Norte Counties (including the cities of Eureka, Arcata, Trinidad, and Crescent City as well as the McKinleyville, Orick, and Klamath communities) would be unaffected by implementing the no-action alternative. Transportation infrastructure would

not be significantly affected, although traffic on Eureka and Crescent City streets and U.S. Highways 101 and 199 would be expected to increase moderately. There would be no adverse impacts on municipal services or fiscal conditions of local governments in the two-county area.

Enforcing existing regulations that restrict RV parking to a single row at Freshwater Lagoon Spit might reduce the number of visitors staying overnight there and, consequently, lower the amount of purchases of goods and services in Orick. This would have a modest adverse effect on Orick's economy and social conditions as well as the fiscal condition of Humboldt County, the primary governmental jurisdiction for this area. Utility infrastructure would not be adversely impacted. Onsite infrastructure within the parks, such as water, sewer, roads, and parking, would be enhanced only modestly as funding from normal operating sources becomes available under the no-action alternative.

Services provided by the private sector, such as grocery stores, restaurants, hotels/motels, RV campgrounds, banks, etc., and used by visitors would likely accrue financial benefits from increased tourism. This might lead to increased private investment in facilities that serve tourists, particularly lodging, restaurants, and recreational services and retail shopping. The Yurok Tribe and/or the private sector would possibly develop a lodge facility as part of its economic development strategy.

Land Use Impacts

There could be some changes in land use designation or zoning use classification due to RNSP land acquisitions for resource protection. Indirect impacts would include modest development of tourism-related infrastructure that could be accommodated under existing land use plans and zoning ordinances.

Impacts on American Indian Tribes

The NPS and CDPR staff would continue consultations with the Yurok Tribe and other American Indian tribes in the area as well as other agencies and cultural preservation interest groups related to issues of mutual concern. RNSP staff would support the private development of a destination lodge outside the parks, including a lodge as proposed for development by the Yurok Tribe. There would be no adverse impacts.

Conclusion

There would be moderate beneficial regional economic effects from increased spending on lodging, transportation, food, fuel, retail goods and services, etc. in the two-county impact area. There could be minor increases in population,

and there would be no adverse effects on housing. Similarly, there would be minor adverse impacts on public services and some modest beneficial impacts on land use planning due to the participation of RNSP staff in gateway community planning decisions. There could also be adverse impacts on the Orick community due to reduced RV user spending on goods and services. There would be no adverse impacts on American Indian tribes in the area under the no-action alternative.

Cumulative Impacts

Please see the discussion of cumulative impacts in the "Socioeconomic Impacts" chapter of alternative 1.

IMPACTS OF IMPLEMENTING ALTERNATIVE 3

IMPACTS ON NATURAL RESOURCES

Soils

Construction activities that could occur with this alternative include (1) removing campsites, waysides, pullouts, and parking areas from wetlands, and picnic and parking areas from Crescent Beach; (2) redesignating, removing, or relocating hiking, equestrian, and mountain bike trails from wetlands and erosion-prone areas; (3) relocating a portion of the Newton B. Drury Scenic Parkway through Elk Prairie; (4) closing Cal-Barrel Road, Tall Trees Grove access road, and the Coastal Drive to vehicular traffic and converting them to trails; (5) reducing the erosion along Howland Hill Road; and (6) removing and restoring the Crescent Beach picnic area. If these actions were implemented, there would be less soil erosion and runoff on RNSP roads than under any of the alternatives, because the trails would be removed or relocated out of wetlands and areas that are prone to erosion. This alternative would also have fewer impacts from construction-related soil erosion than any of the other alternatives.

Complete landform restoration on parklands would be used to treat approximately 9.4 miles of major roads and 99 miles of associated minor roads per year. Within 17 years, 155 miles of major roads and 1,643 miles of associated minor roads would be removed. The same mileage of major roads would be treated in about the same time as in alternatives 1 and 4, but more complete restoration treatments would be accomplished under alternative 3. More miles of minor roads would receive treatment under alternative 3 than under alternatives 1 and 4.

Overall, this alternative provides the greatest short- and long-term benefits to the biological and physical functioning of the lower part of the Redwood Creek watershed. Alternative 3 would more extensively reduce the erosion potential at stream crossings and along all intervening road

segments through the complete restoration of landforms, hydrology, and vegetation along all roads. Long-term protection of downslope and downstream aquatic habitats would occur as buried topsoil was recovered and redistributed on the finished surface, helping to reestablish vegetation along the removed roads. Prelogging topography would be restored along the treated roads and would improve the visual quality of the basin as roads were removed and the area was recontoured and revegetated. This alternative would have the greatest long-term benefit for terrestrial, riparian, and aquatic habitats in the tributaries of Redwood Creek than of any of the alternatives because the potential for failure of road sections that had not been identified as threats during road inventories would be reduced, thus reducing damage to downslope old-growth redwood forests and recovering second-growth forests and their associated ecosystems.

Erosion control upstream of the national park would depend on landowner cooperation and the availability of nonpark funding sources. Road decommissioning and erosion prevention treatments would be used to reduce the erosion potential of up to 54 miles of logging roads per year. About 911 miles of roads would be treated in 17 years, the same as alternatives 1 and 4. Where road decommissioning was undertaken, areas prone to landslides and areas with potential for delivering sediment to streams would be treated, and stream crossings would be returned to their original configuration.

Road decommissioning would decrease the potential for erosion from more roads more quickly than with landform restoration treatments used on parklands because only those road segments that could contribute sediment directly to the streams would be treated. However, there is the possibility that road sections that were not identified as having high erosion potential and that were not treated could fail after treatment was completed. Failures of the remaining untreated road segments would continue but would not directly impact downstream aquatic resources of the park (assuming that decisions

were correct in assessing which road segments have potential to deliver sediment to the stream system). This alternative would have a moderate beneficial impact on aquatic habitats and alluvial redwood groves along the main stem of Redwood Creek upstream and within the national park.

Conclusion

The ongoing use, maintenance, and management of roads, trails, and facilities would cause minor disturbances to soils, such as soil erosion and soil compaction. The removal or relocation of roads, trails, campsites, and other facilities out of wetlands and areas prone to erosion would have the minor beneficial impact of reducing soil erosion and compaction that could impact vegetation, aquatic resources, wildlife, cultural resources, and water quality.

Watershed restoration activities on parklands in Redwood Creek basin, done through complete landform restoration, over the long term would best protect the resources in the lower basin against road-related erosion, and would more completely restore the predisturbance landforms and surface hydrology and protect terrestrial, riparian, and aquatic resources of the national park. Over the long term, alternative 3 would have the greatest beneficial impact on the national park's resources through the complete removal of abandoned logging roads, the restoration of landforms, soils, vegetation, and hydrologic patterns on parklands in the lower basin.

Upstream of the national park, road decommissioning and erosion prevention treatments would quickly protect downstream aquatic habitats and alluvial redwood groves against the immediate erosional threats from a large storm. Erosion control treatments upstream from the national park would have a moderate beneficial impact on downstream aquatic and riparian resources in and along the main stem of Redwood Creek.

Cumulative Impacts

Over the long term (decades to centuries), watershed restoration treatments on parklands in lower Redwood Creek basin and cooperative erosion control activities upstream of the national park would have a major beneficial cumulative impact of reducing soil erosion and sedimentation that have been adversely affecting downstream resources such as wildlife, water quality, vegetation (alluvial redwood groves, riparian vegetation, and hillslope forests and prairies), and aquatic and riparian habitats in the tributaries and main stem of Redwood Creek. Of the four alternatives, alternative 3 treats the causes of erosion most completely.

Water Quality

Over the long term, watershed restoration activities within Redwood Creek basin would have the beneficial impact of reducing point and nonpoint source pollution (increased sediment loads) into RNSP streams. Increased suspended sediments and turbidity in the parks' streams caused by erosion of stream crossings would be eliminated faster than under any of the other alternatives.

In the short term, partial levee removal would result in more sediment being washed into Redwood Creek, increasing turbidity in the river. But over the long term, land acquisition and partial levee removal would cause the water quality to improve because vegetation would become reestablished in the riparian zone, water depths in the estuary would increase allowing agricultural runoff, and sediment would be more easily diluted and washed out to sea. Partial levee removal and restoration of the riparian vegetation would help improve water quality in the slough, stream, and estuary by providing a biological filter for contaminants, decreasing streamside erosion, and decreasing temperatures along the streambanks.

As part of restoration of the Redwood Creek estuary, the necks of the north and south sloughs would initially be dredged to accelerate the

return of historic water depths and circulation patterns. This would result in short-term increases in turbidity in the lower river and long-term improvement in the water quality in the sloughs. If the south slough culvert was retrofitted as part of the restoration efforts, water quality should increase because water circulation in the slough would be improved. Partial levee removal would assist in reestablishing natural processes and biologic communities in the estuary and would contribute to improving the overall water quality in the estuary.

Waste at existing and proposed state park campgrounds and at remote campsites might have an adverse impact on water quality if not disposed of properly. Water quality monitoring at state park campgrounds would ensure that if a water quality problem existed, it would be promptly taken care of. The elimination of overnight camping at Freshwater Lagoon Spit would result in a localized major beneficial impact on water quality because improper effluent disposal would be reduced or eliminated altogether.

Impacts on water resources caused by private land uses would depend on the level of cooperation between private landowners and RNSP staff and the willingness of other agencies to apply their water resources protection programs.

Conclusion

Removing 0.6 mile of both of the levees in the lower Redwood Creek valley would cause a minor, localized, short-term increase in turbidity. Beneficial impacts on water quality would occur over the long term as vegetation was reestablished in the riparian zone, water depths increased in the estuary, ranching activities in the lower valley were reduced, and overnight camping was eliminated at Freshwater Lagoon Spit. Waste at existing and proposed campgrounds could cause adverse water quality problems if not properly disposed of. Partial levee removal and area restoration would provide more benefit to water resources in the estuary than with actions proposed in any of the other alternatives.

Cumulative Impacts.

There would be a major beneficial cumulative local impact on water quality in Redwood Creek estuary from the restoration of the natural and biological processes in the estuary and from the extensive watershed restoration upstream of the lower Redwood Creek valley.

Floodplains

Acquiring interests from willing sellers in lands in the lower Redwood Creek valley, removing the lower 0.6 mile of the 3.4-mile federal flood control levees, and discontinuing controlled breaching of the sandberm at the mouth of the river would allow Redwood Creek to migrate across its lower floodplain and would help reestablish natural physical and biological processes in the lower river and estuary. The north and south levees would be removed to the first bend in the creek east of the estuary (see previous Expanded Floodplain/Levee Removal map). Partial levee removal would increase the current 100-year floodplain by 332 acres of private and federal land (David Anderson, RNSP fishery biologist, pers. comm., 12/12/97).

Because the river would no longer be constrained by the levees, there would be periodic flooding. Although land in the lower valley would flood more frequently following levee removal, floods would no longer have the adverse effect of inundating ranchland or precluding grazing, because up to 130 acres of land would be acquired from willing sellers and managed as undeveloped, natural land. Up to 95 acres of land that lie below 10 feet above mean sea level could continue to flood periodically in summer and fall when the estuary closes and the embayment water level rises. Other areas of the estuary that would not be acquired could also be periodically flooded.

Fluvial processes would be restored to the original last meander in the river (the south slough), allowing for some additional circulation in the north slough during high flows.

Sedimentation would likely occur in the south slough area as winter flows recede, but a natural riffle/pool sequence would probably redevelop, and overall pool depth and volume would be expected to increase in the estuary as the flows seasonally scoured the riverbed and estuary. Initially, the necks of the north and south sloughs would be dredged to accelerate the return of historic water depths and circulation patterns. This would result in short-term increases in turbidity in the lower river and long-term improvement in the water quality in the sloughs. The south bank of the south slough lacks riparian vegetation and would likely erode as natural river migration occurs.

Through time, natural vegetation would become reestablished in the lower Redwood Creek

valley, and wildlife and aquatic habitat would be improved in these areas. Over the long term, this alternative would provide the greatest benefit to the natural environment by restoring estuarine processes and conditions.

Disturbed lands restoration would reduce the overall amount of sediment entering Redwood Creek and its tributaries and would assist in the recovery of downstream plant and animal communities, stream morphology, and hydrologic and biological processes. Siltation and aggradation, increased bank erosion, and channel widening in Redwood Creek basin streams would continue to occur and would lessen as roads, road benches, and stream crossings were treated. The erosion potential of treated roads would be eliminated upon

TABLE 28: SUMMARY OF MANAGEMENT ACTIONS IN LOWER REDWOOD CREEK AND THEIR IMPACTS ON RIVER MORPHOLOGY, FLOODPLAINS AND THE ESTUARY UNDER ALTERNATIVE 3

Management Action	Impact
Acquire interest in lands in lower Redwood Creek valley	Willing sellers would be compensated for up to 130 acres of agricultural land removed from production. Other private agricultural land that remained in production would be periodically flooded. Acquisition from willing sellers would allow more complete restoration of the floodplain and estuary and would eliminate the need to protect private property from flooding.
Remove lower 0.6 mile of federal flood control levees on Redwood Creek (up to the first upstream meander in the river)	Would help restore natural hydrologic and biologic processes in the estuary, increase embayment depth, improve summer water quality and aquatic habitat, increase size of 100-year floodplain by 332 acres, improve fertility of floodplain soils, increase extent of wetlands, increase water circulation in north slough during high flows and increase the extent of winter flooding. Improved circulation would scour the sloughs and eliminate the need for periodic follow-up dredging. Up to 12 structures could be flooded on the restored floodplain.
Discontinue channel manipulation to protect the Redwood Information Center	Redwood Information Center could be destroyed by river migration or other natural processes before it was salvaged and removed. If this occurred, it would not be rebuilt in its current location.
Dredge north and south sloughs	Would temporarily increase turbidity, improve water quality over the long-term, and help reestablish historic water depths in the estuary more quickly; aggradation and overwash would continue to occur.
Elevate Hufford Road	Would eliminate 0.09 acre of wetland/floodplain, and ensure access for landowners during periods of flooding.
Restore riparian vegetation	Would decrease stream temperatures, increase salmonid habitat, and act as filter for pollutants in the water.
Watershed Restoration Activities (disturbed lands restoration)	Decreased sediment inputs from upstream would have the major beneficial impact over the long term of reducing downstream streambed migration, aggradation, channel widening, and streambank erosion, and increasing deepwater pools.

completion of the watershed restoration program, even though the downstream beneficial effects of these treatments might take decades to centuries to be fully realized.

Conclusion

Partial levee removal and the restoration of the natural physical and biological processes in the lower Redwood Creek valley and Redwood Creek estuary would provide more benefit to the natural environment than any of the other alternatives. Acquiring interests in the lands and removing 0.6 mile of the levees in the lower Redwood Creek valley would also improve aquatic habitat and water quality and increase the size and extent of the wetlands and floodplain. Partial levee removal would have the major adverse impact of displacing property owners and removing up to 130 acres of land from agricultural production. Dredging the sloughs would temporarily increase turbidity in the estuary but would help reestablish its historic water depths, a beneficial impact on fisheries and water quality. Elevating Hufford Road would ensure access for landowners during floods.

Cumulative Impacts

This alternative would have a major beneficial cumulative impact from the partial removal of the federal flood control levees and the restoration of the hydrologic and biological processes and configuration of the estuary and from the restoration of cutover lands in Redwood Creek basin.

Wetlands

Impacts of Watershed Restoration

This alternative would have the greatest long-term benefit for riverine and palustrine wetlands in the parks because all roads would be treated and landforms would be completely restored in the shortest time.

Impacts of Estuary Restoration

Impacts on the estuary under this alternative would be the same for similar actions conducted under the proposed action. A greater benefit would be expected under this alternative because many actions would be combined to restore estuarine processes while the proposed action might not include a combination of actions.

Removing both sides of the 3,150 feet (0.6 mile) of levee closest to the ocean (of the 3.4 total miles of levees) would increase the overall area of wetland because water confined within the levees would spread out over a larger area near the mouth of the creek. Based on the increase in acreage of floodplain, the area of wetland would be estimated to increase by about 200 acres. The associated functions and values of these wetlands would include flood attenuation, wildlife and fish habitat, and aesthetic benefits.

High flows during the winter would inundate more of the original floodplain. Periods of inundation that currently vary from irregularly flooded at the south slough to irregularly exposed for the north slough would be expected to increase so that portions of the 200 acres would be flooded for longer periods each year, depending on the amount of precipitation and when it was received. Based on the location of the new wetlands in relation to the present wetland types, the amount of estuarine wetland would be expected to increase by at least 25 acres and palustrine wetlands by about 175 acres. If dredging was combined with partial levee removal, the percentage of estuarine wetland would be expected to be greater.

Impacts of Levee Removal

After removing the lower portion of the levees, and discontinuing controlled breaching of the sandberm, there would be more widespread flooding in the valley. The soils in the floodplain would be inundated more frequently and for longer periods of time. Soils would become more hydric and more fertile as silt was deposited during periods of flooding.

Removing the lower portions of the levees would partially restore channel dynamics, resulting in increased channel depth and water circulation in the estuary. The levees reduced the area of embayment by cutting off the south slough. As a result, less water would be needed to fill the embayment. Sediment from upstream has been deposited in the estuary, and also has reduced volume of the embayment. Under this alternative, water circulation would increase in the tidal wetlands in the last meander of Redwood Creek and in the north and south sloughs that have been dewatered by the levees. Increased circulation would be anticipated to move sediment out of the estuary. This would be considered a beneficial impact on estuarine wetlands.

Discontinuing the breaching of the sandberm at the mouth of the creek during the summer would result in a larger embayment and an increased area of palustrine and estuarine wetland until high flows breached the sand berm naturally.

Conditions that favor growth of riparian vegetation would be reestablished following partial levee removal. The type of vegetation would depend on berm development, because the berm separates the saline ocean waters from the fresh-water in Redwood Creek. Wetland vegetation would develop on some newly created wetland areas. Existing wetland vegetation might be inundated and replaced by another type of vegetation. There are historic reports that Sitka spruce became established following the large floods of 1861–62 and 1890. Currently vegetated areas that become permanently flooded would lose vegetation. The original vegetation would not be restored on adjacent private lands under agricultural production. There would be an increase in the overall area of wetland vegetation, a direct benefit.

The removal of the lower portion of the levees would increase the depth and frequency of flooding of adjacent lands at high flows, but might reduce flooding at lower flows when the berm forms — based on reports from some local residents that flooding of the agricultural lands

has increased since the levees were constructed. The cessation of breaching of the berm at the mouth of the creek would increase the frequency of flooding of adjacent pastures. However, increased depth and circulation might result in higher volumes needed to fill the embayment, so that flooding of adjacent pasture might be reduced when the sandberm forms.

Acquiring flood easements would increase the extent of seasonal wetlands by allowing floodwaters to spread out over agricultural lands. However, native wetland vegetation would not be restored on private agricultural land. There would be an overall benefit for wetlands from restoring the flood attenuation function of the wetland.

Impacts of Second-Growth Forest Management

There would be minor localized benefits for perennial and intermittent stream channels (riverine wetlands) in about 7,900 acres of second-growth forest to the extent that vegetation patterns and drainage patterns were restored. There would be very minor localized indirect adverse impacts on stream channels from managing second-growth forest stands and from runoff from disturbed soils if heavy equipment was used to remove downed trees or if slash burning was used to reduce fuel following the removal of second-growth trees.

Impacts Related to Artificial Impoundments

This alternative would result in the greatest benefit of any of the alternatives to naturally occurring wetlands from the immediate removal of the dams and the restoration of natural wetland functions and values of Richardson Creek and Lagoon Creek. There would be temporary adverse impacts on wetlands around the dam site when the dams were removed. There would be indirect adverse impacts when the ponds were removed on wetland wildlife, aesthetic, and recreational values because of adverse impacts on waterfowl that use the ponds and visitors who enjoyed watching the waterfowl.

Impacts Related to Visitor Use

This alternative would result in fewer adverse impacts on wetlands from the construction, use, and maintenance of campgrounds because no new campgrounds or primitive campsites would be constructed. There would be benefits to wetlands from removing campsites in the floodplain of the Smith River at Jedediah Smith Redwoods State Park, and in riparian areas adjacent to Prairie Creek at Elk Prairie campground in Prairie Creek Redwoods State Park.

This alternative would result in fewer adverse impacts on wetlands from the construction, use, and maintenance of trails because no new equestrian or mountain bike trails would be constructed, and because the maintenance of existing hiking trails rather than the construction of new trails would be emphasized.

About 0.5 acre of coastal palustrine wetland would be restored following the removal of the picnic area, parking, and associated facilities at Crescent Beach.

Impacts from Visitor Access and Circulation

The relocation of the Elk Prairie section of the Newton B. Drury Scenic Parkway would require site-specific planning to determine the amount of wetlands and wetland functions and values that would be affected. About 2,000 square feet of riverine and palustrine wetlands and associated riparian areas at Boyes Creek could be affected by removing the road crossing. Functions and values that might be affected include habitat for coho salmon and other anadromous fish, other aquatic wildlife and amphibian habitat, groundwater discharge, flood attenuation, and esthetics.

Retaining the Del Norte Coast Redwoods State Park entrance road would result in no new impacts on wetlands.

The degree of impact on the stream crossing at Fern Canyon from improvements to the Gold Bluffs Beach Road would be less than under current conditions because fewer private vehicles

would cross the stream if alternative transportation methods such as shuttles were available. Annual maintenance would continue to result in short-term adverse effects on the 900 square feet of stream crossing. Relocating the parking area out of the stream channel at Fern Canyon would restore about 20,000 square feet of wetland.

The removal of Cal-Barrel, Tall Trees Grove access, and Coastal Drive roads and reconstruction as trails would result in short-term adverse impacts on small isolated wetlands and headwater stream channels and long-term benefits from restoring original landforms and drainage patterns. Minor impacts from the erosion of bare soils following road removal and restoration would continue until revegetation occurred. There would be minor benefits for wetlands because dust control would no longer be needed and petroleum leakage from motor vehicles would be eliminated. Long-term beneficial impacts on riverine wetlands in several Redwood Creek tributary drainages would result from restoring the original landforms and stream channels following the removal of the access road to Tall Trees Grove. This alternative would have a greater potential benefit for wetlands associated with coastal headwater drainages because the Coastal Drive would be converted to a trail before a major failure that could have potentially significant adverse impacts on nearby wetlands.

Improving drainage structures along Howland Hill Road and controlling areas with the potential for erosion and contributing sediment into streams would result in minor short-term impacts from erosion but would provide long-term benefits for stream channels and associated resources. Controlling possible erosion would reduce the possibility of major road failure and would provide beneficial long-term impacts on Mill Creek.

There would be a minor benefit to sandy shoreline and estuarine wetlands at the Redwood Creek estuary when the Redwood Information Center was salvaged and the site was turned to day use.

Conclusion

Watershed restoration with an emphasis on complete landform restoration within and upstream of the national park would have a major positive effect on intermittent and perennial stream channels immediately downstream from those areas where original landforms were completely restored. Other downstream wetlands would benefit indirectly from restoring natural drainage patterns and reducing sediment delivered into the streams.

The area of wetlands associated with the Redwood Creek estuary would increase by about 200 acres if the lower 0.6 mile of levee on both sides was removed. More natural circulation and drainage patterns would be restored.

There would be major long-term benefits for stream crossings and downslope wetlands from removing Cal-Barrel Road, the access road to the Tall Trees Grove, and Coastal Drive. The original functions and values of stream channels and streamside wetlands would be restored. The primary wetland functions and values anticipated to be restored through road removal include natural vegetation patterns and habitat for amphibians; aesthetics; and drainage patterns. There would be minor benefits on wetlands and on Mill Creek from erosion prevention and drainage improvements to Howland Hill Road. There would be adverse impacts onto Boyes Creek from relocating Newton B. Drury Scenic Parkway if a new alignment across Boyes Creek was chosen.

Vegetation management, including fire management, prairie restoration, and the management of second-growth forests, would indirectly benefit intermittent and perennial stream channels by restoring naturally occurring vegetation and drainage patterns.

Cumulative Impacts

This alternative would have major positive long-term cumulative benefits for wetlands from restoring watersheds and restoring the Redwood

Creek estuary; managing second-growth forest to restore vegetation and drainage patterns; removing several public roads and reconstructing them as trails; restoring a small amount of coastal wetlands at Crescent Beach and at the Redwood Information Center after removal; and relocating trail segments out of wetland areas. There would be minor adverse impacts on the aesthetics, recreational opportunities, and wildlife habitat provided by Marshall Pond and Lagoon Creek when those impoundments were removed.

Threatened and Endangered Species

Impacts from Watershed Restoration

Watershed restoration involving complete landform restoration under this alternative would have major long-term benefits for coho salmon and other anadromous fish. There would be a greater direct benefit to fish than to northern spotted owls and marbled murrelets because the primary benefit of watershed restoration is the reduction of sediment delivered to streams. Short-term benefits on the order of 1 to 50 years would be anticipated to be substantially greater for coho salmon and other anadromous fish than for owls and marbled murrelets because of the 40 to 100 years required for forests to regrow into marginally suitable nesting habitat for owls and murrelets, respectively, is thought to be longer than the time required for stream channels to acquire suitable spawning habitat and deep pools.

Road removal and watershed restoration in seven tributary subbasins in the lower Redwood Creek watershed — Lost Man (including Little Lost Man), Forty-four, Tom McDonald, Elam, Bond, Lower Prairie (main stem below StreeLOW, StreeLOW, Skunk Cabbage), and Bridge Creeks — would provide the greatest short- and long-term benefits for populations of coho salmon and other anadromous fish. Restoring other tributary watersheds in the Redwood Creek basin would provide moderate to minor benefits for coho salmon and other anadromous fish. Watershed restoration upstream of the national park would

have minor to moderate benefits on coho salmon and other anadromous fish from reducing sediment delivered into the main stem of Redwood Creek and through restoring habitat, including deep pools and clear channels that allow fish to move into the tributaries to spawn.

Complete landform restoration proposed for a greater area under this alternative would result in greater long-term benefits for owls and murrelets because forest regrowth would be more complete and fragmentation would be reduced.

Impacts of Estuary Restoration

Restoring the Redwood Creek estuary under this alternative would result in major long-term benefits to juvenile coho salmon and other anadromous fish because the quality and quantity of rearing habitat would increase. The improved survival of juvenile fish would eventually lead to an increase in populations of adults returning to spawn. There would be temporary indirect adverse impacts on fish from reducing water quality through increased turbidity due to the disturbance of banks for partial levee removal and dredging to deepen the channel. Restoring the estuary would have a major benefit for tidewater goby habitat.

Direct adverse impacts on juvenile coho salmon and other anadromous fish would result from illegal uncontrolled breaching in summer when juvenile anadromous fishes were in the estuary and water levels affected private property, or if the parks could not obtain a breaching permit.

This alternative would result in minor long-term indirect benefits for snowy plover habitat from restoring nesting habitat adjacent to the estuary and on beaches. Although nesting habitat might be restored, continued disturbance from humans might prevent successful plover nesting.

Impacts of Second-Growth Forest Management

This alternative would be expected to have major long-term benefits on northern spotted owls and marbled murrelets from increasing the suitable

nesting habitat in the parks by treating up to 45,000 acres of second-growth forest to speed the recovery of characteristics of old-growth forest suitable for murrelet and owl nesting. If all treated lands attained characteristics suitable for murrelet nesting, suitable nesting habitat in Redwood National and State Parks would increase from 43,000 acres to 88,000 acres. The benefit to owls would be expected to be realized sooner than a benefit to murrelets because owls are known to nest in second-growth trees as young as 40 years old whereas murrelets require nesting platforms that are usually present only in older and larger trees.

The degree of benefit to owls and murrelets would be greatest under this alternative because the restoration of stands critical to the redwood ecosystem would be the primary objective of second-growth forest management.

There would be no short-term adverse impacts on marbled murrelets from noise and disturbance during second-growth forest management because these stands are not suitable murrelet nesting habitat.

The removal of trees greater than 18 inches diameter at breast height or greater than 40 years of age in some stands of second growth might result in short-term minor adverse impacts on northern spotted owls from noise and disturbance and the removal of potential nesting habitat. The short-term impact is not considered significant because of the amount of more suitable habitat available elsewhere. Because the objective of second-growth forest management under this alternative would be to restore characteristics of the old-growth ecosystem, it is likely that trees large enough to be suitable for nesting would not be removed. Direct adverse impacts on owls would be avoided through the survey of areas to be managed. If owls were found to have established territories in or immediately adjacent to these areas, the area would be treated outside the nesting season or through other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service or the trees would be allowed to remain.

Impacts of Prairie Restoration

Prairie restoration in the Bald Hills under this alternative would have short-term adverse impacts on northern spotted owls from the removal of Douglas-fir trees larger than 18 inches in diameter. This impact would be minor because other more suitable nesting habitat occurs relatively close to the prairies. Areas to be restored would be surveyed for the presence of owls before the removal of any trees to avoid direct adverse impacts on owls.

Impacts of Fire Management

Conducting prescribed fires would allow the location, timing, and extent of fire to be controlled, reducing direct adverse impacts on northern spotted owls and marbled murrelets from drifting smoke or the destruction of nesting habitat. Catastrophic crown fires in old-growth redwood forest are rare but would have direct major adverse impacts on critical habitat of marbled murrelets if such a fire occurred in one of the state parks. Prescribed fire in old-growth habitat would reduce the potential for large damaging fires by reducing unnatural fuel build-up.

Conducting prescribed fires and allowing some wildland fire use throughout the parks would reduce fuel loads that increase the chance of a large, damaging fire. Large fires would have major direct and indirect short- and long-term adverse impacts on vegetation and wildlife. Direct short-term adverse impacts of large fires include smoke, heat, and the destruction of vegetation and less mobile wildlife. Long-term adverse impacts of large destructive fires include loss of old-growth forest habitat for marbled murrelets and northern spotted owls and the destruction of riparian vegetation that creates shade in streams used by coho salmon and other anadromous fish. Short-term indirect adverse impacts are noise and disturbance from fire suppression equipment and personnel. Long-term indirect adverse impacts of fire suppression might include construction in suitable marbled murrelet and northern spotted owl habitat of large fire breaks that would increase forest

fragmentation. Erosion and runoff of sediment from severely burned areas, fire breaks, and fire roads would adversely affect spawning streams of coho salmon and other anadromous fish.

Prescribed fire and wildland fire use to meet resource management strategies could reduce understory vegetation without losing trees, which may occur with crown fires that result from long periods of fire suppression and buildup of fuels. Crown fires would have direct adverse impacts on forest habitat occupied by northern spotted owls and marbled murrelets from the destruction of habitat, smoke, and the disturbance from fire suppression equipment and personnel.

Underburning reduces unnatural fuel buildup. Fires in forest stands that have had undergrowth reduced through prescribed fires are less severe, which increases the effectiveness of suppression efforts when needed and reduces the duration and extent of noise and disturbance to owls and murrelets.

The reintroduction of fire into old-growth forests would have direct short-term adverse impacts on owls and murrelets from smoke and disturbance. Disturbance to owls and murrelets would be avoided by surveys to locate owl territories and occupied murrelet habitat as part of project planning for old-growth burns. Any prescribed fires in old-growth forest would be scheduled outside of the nesting season or through other methods authorized through section 7 consultation with the U.S. Fish and Wildlife Service to avoid direct adverse impacts on nesting birds.

Impacts Related to Artificial Impoundments

Dam removal and the restoration of stream spawning habitat following removal of Marshall Pond would directly benefit coho salmon and other anadromous fish by restoring 1,500 feet of stream channel in Richardson Creek.

Impacts Related to Visitor Use

Under this alternative, the area of developed zone would be the least, and the area of primitive zone in which no development or facilities were permitted would be the greatest of any alternative. Noise and disturbance to owls and murrelets would be slightly less than under the proposed action because some planned trails and campsites might not be constructed, construction might be postponed, or the planned facilities might be in areas that would not be suitable owl or murrelet habitat. An emphasis on maintenance rather than construction of new hiking, horse, or mountain bike trails would reduce by about 9% the acreage of old-growth forest in the parks that would be affected by trails. A total of 22,240 acres of old growth, about 54% of the parks' total, would be within 0.25 mile of roads, trails, or facilities existing in 1997 — potentially increasing the risk of predation. About 23 miles of trails would be removed under this alternative, and 60 miles of planned trails would not be constructed because these trails have been planned for areas that would be included in the primitive zone. Visitor use on well-established trails would not be anticipated to be high enough over the life of this joint plan to create adverse effects on owls or murrelets.

There would be a very slight increase in suitable habitat for marbled murrelets and spotted owls if campsites were removed from campgrounds in old-growth forest habitats. There would be a slight benefit because fewer trees would be classified as hazard trees in developed campgrounds. Benefits under this alternative would not be major unless a campground was removed entirely, because campground use would continue to generate noise and disturbance.

Impacts from Visitor Access and Circulation

Cal-Barrel Road and parts of the Coastal Drive pass through old-growth forest. Converting these roads to hiking trails would reduce visitation and required maintenance, which would benefit marbled murrelets and northern spotted owls that occupy old-growth habitat:

Conclusions

Watershed restoration within and upstream of the national park would have major benefits for coho salmon and other anadromous fish by reducing the sediment delivered into streams and restoring stream channels, thus increasing the quantity and quality of spawning and rearing habitat. Restoring the Redwood Creek estuary would increase the quantity and quality of rearing habitat for juvenile coho salmon and other anadromous fish, and habitat in general for the tidewater goby. Improved survival of juvenile coho salmon and other anadromous fish would be expected to increase populations of adult fish that return to spawn. Northern spotted owls and marbled murrelets would benefit over the long term from watershed restoration through a reduction in the fragmentation of the forest, but this benefit would be slight compared to the restoration of suitable nesting habitat through second-growth forest management. The benefit from second-growth forest management would be a long-term benefit expected to begin when the trees in the first areas treated attained characteristics suitable for nesting, on the order of 40 years (for owls) to 100 years (for murrelets).

Establishing an aggressive fire management program would have an indirect moderate long-term benefit for all endangered species from restoring a natural process that contributed to the creation of the natural vegetation patterns of the parks. Aggressive fire management would also indirectly benefit all threatened and endangered species over the long term by preventing large damaging fires. Noise and disturbance to northern spotted owls and marbled murrelets would be slightly less under this alternative because fewer facilities and miles of trails would be constructed in old-growth habitats, and some roads through old growth would be removed.

Cumulative Impacts

This alternative would result in minor short-term adverse effects and a major long-term positive cumulative effect on northern spotted owls and marbled murrelets from restoring suitable habitat

through second-growth forest management, through establishing an aggressive fire management program, and through watershed restoration to the extent that forest fragmentation was reduced by landform restoration. Moderate positive cumulative effects on coho salmon and other anadromous fish would result from watershed restoration using complete landform restoration in combination with watershed restoration projects in the Redwood Creek basin upstream of national park boundary and the restoration of the Redwood Creek estuary. There would be a major positive cumulative benefit for tidewater goby habitat from restoring the estuary in combination with reducing sediment through watershed restoration upstream. A slight reduction in the development of visitor facilities, including roads and trails, would contribute a small positive cumulative effect, primarily for northern spotted owls and marbled murrelets.

IMPACTS ON CULTURAL RESOURCES

New facilities (trailheads and trails, and picnicking and camping sites, as well the relocated Newton B. Drury Scenic Parkway) would be sited to avoid adversely impacting known cultural resources, including potential cultural landscapes.

Salvaging the nonhistoric Redwood Information Center and converting the surrounding area to day use (including beach access, boardwalks, and wayside exhibits), as well as removing the nonhistoric Hiouchi information center would have no impact on RNSP cultural resources.

Before converting the Coastal Drive, which is listed on the National Register of Historic Places, to a trail, the effects of the action would be evaluated in consultation with the California state historic preservation office and the Yurok tribal heritage preservation officer. Before converting Cal-Barrel Road and the Tall Trees access road to trails, the roads' eligibility for inclusion on the National Register of Historic Places would be evaluated in consultation with

the California state historic preservation office. If the roads were determined eligible for the national register, conversion of the roads to a trails could proceed after following applicable consultation procedures.

Expanding and enhancing the RNSP curatorial program would improve the preservation, research, and interpretation of the parks' collections. In addition to better preserving museum artifacts and archival materials, the curatorial program would improve record-keeping and the retrieval of information pertaining to the management and administration of the parks.

Conclusion

Alternative 3 presents a less comprehensive and integrated approach to resource management, interpretation, and visitor services than does the preferred alternative; however, actions proposed under this alternative would provide the greatest protection for cultural resources. With appropriate mitigation, there would be no adverse impacts on cultural resources.

Cumulative Impacts

Cultural resources potentially impacted by construction of a federally funded visitor center outside the parks would be accorded the protection of federal preservation laws. Other actions occurring outside of the parks, such as watershed restoration, could adversely impact cultural resources not offered the protection of federal or state laws.

Cumulatively, cultural resources would benefit from the following:

- Assistance that could be provided to protect cultural resources affected by watershed restoration or construction of a federally funded visitor center outside of the parks' boundaries.

- Removal or relocation of noncontributing, intrusive features from the parks' cultural landscapes.
- Increased public understanding of and sensitivity to the importance of the parks' cultural resources.
- An expanded and enhanced curatorial program.

IMPACTS ON VISUAL QUALITY

Due to the inherent visual sensitivity of landforms and land cover within this region, watershed and vegetation management actions under this alternative could result in appreciable impacts on visual resources. These impacts would be most visible on forested and open hillsides as well as open flat areas, such as estuaries. Disturbed lands restoration activities altering terrain or vegetation could impact the line, form, color, texture, and visual density of the landscape. Impacts would affect visual experiences in both micro and macro landscapes. The extensive watershed restoration and vegetation management activities specified in this alternative could initially have negative visual impacts with gradually occurring long-term visual benefits.

This alternative emphasizes preservation and protection of cultural resources. Negative visual impacts within visually sensitive areas could be minor. Overall visual quality would greatly depend on project-specific visual analysis for all actions resulting in changes to cultural landscapes and associated elements.

Removing or relocating access roads, parking areas, trailheads, and associated facilities in visually sensitive areas could result in short-term negative visual impacts primarily affecting the micro landscape experience. Removing or relocating hiking, equestrian, and mountain biking trails as well as picnic and camping facilities from sensitive resource areas could result in long-term benefits. However, these actions would reduce landscape viewing experiences. Likewise, actions intending to limit

scenic pullouts could result in long-term viewshed benefits but would also decrease macro landscape viewing opportunities. Overall visual quality would greatly depend on project-specific visual analysis for all actions resulting in the removal, relocation, or installation of visitor use and interpretive facilities. This alternative limits visitor use to levels that would result in only minor impacts on resources and their values and therefore the visitor experience.

Coastlines and coastal environments are highly sensitive visual resources due to intensive dynamic contrasts and extensive viewsheds. The elimination of overnight camping on Freshwater Lagoon Spit would greatly improve the visual condition, thereby restoring much of the area's natural visual character.

Community planning actions related to viewshed protection and acquisition of lands with significant scenic value would greatly enhance the preservation of regional landscape character. Identifying and protecting visual/scenic resources along highway corridors and roads could result in substantial long-term visual benefits. Negative visual impacts resulting from new road development or road maintenance activities could be relatively minor in this alternative. Road relocation or removal activities would result in short-term negative visual impacts with gradually occurring long-term visual benefits.

Conclusion

Under this alternative there would be relatively minor impacts on visual and scenic resources. Most negative impacts would be short term and ultimately result in long-term visual benefits. Overall, visual and scenic quality would directly depend on project-specific visual analysis studies and design implementation. This alternative would result in the most complete restoration of landforms and hydrology of all of the alternatives and, over time, Redwood Creek basin would become more aesthetically pleasing and have a more natural appearance for park visitors.

Revegetation of the area would occur soon after restoration activities were completed, but restoration of the visual appearance of an old-growth redwood forest would take decades or more to occur, a minor beneficial impact. Coastline management and viewshed protection actions would enhance landscape character and result in major long-term visual and scenic benefits.

Cumulative Impacts

Cumulative visual and scenic impacts include those previously occurring within and surrounding RNSP properties as well as those identified under this alternative. Previous land use activities have impacted the indigenous visual character of virtually all landscape units. The major cumulative visual impacts of the extensive timber harvesting, road and highway alignments, and other development activities would remain highly visible throughout the region. Under this alternative watershed restoration activities as well as the identification and reduction of impacts on visually sensitive areas and coastline management and viewshed protection actions would have a cumulative long-term beneficial impact on visual and scenic resources.

IMPACTS ON VISITOR ACCESS AND CIRCULATION

Impacts on circulation under alternative 3 would be mixed. Many of the internal roads (Cal-Barrel Road, Tall Trees access road, and Coastal Drive) would be converted to trails. This would result in the restriction of significant areas of the parks to nonmotorized activities (hiking, equestrian use, mountain bikes). This would force the consolidation of vehicle access to the major roads and the highways causing traffic and congestion. Increased development to accommodate this change would occur along the roads and highways. The development would take the form of new parking areas and trailheads.

The increase in automobile traffic on the highways and main roads brought about by the conversion of roads to trails would be offset by the relocation of the Redwood Information Center and Hiouchi information center functions to locations outside of the parks. This would reduce traffic in the parks in the area of their existing locations but increase traffic at the new locations outside of the parks (the Crescent City headquarters area and the site of the new primary visitor center).

The alternative would result in major changes in the visitor use patterns. The opportunity for and the quality of pedestrian activities would be greatly enhanced. Some of the most popular old-growth areas of the parks would become accessible only by hiking, equestrian use, or mountain bikes.

IMPACTS ON THE QUALITY OF THE VISITOR EXPERIENCE

Visitor Use Opportunities

This alternative does not include any actions that would increase visitor use opportunities. Visitor use and access to sensitive natural and cultural resource areas would be severely restricted, and fewer visitors (than under existing conditions) would have the opportunity to experience those resources directly.

The new primary visitor center would provide visitors with opportunities to learn about the parks' significant resources and related primary interpretive themes at a much more comprehensive level than the introductory information currently available at the parks' visitor facilities. The use of a variety of interpretive media would lessen visitors' dependence on direct interaction with trained interpretive staff to provide in-depth interpretation and would accommodate the different learning styles and preferences of individual visitors. The location outside the parks might not provide the kind of direct connection between the interpretive messages

and the resources being interpreted that a site inside the parks would provide.

RNSP management would consider removing and/or relocating campsites out of sensitive resource areas. No new camping areas are proposed under this alternative. Even if the campsites were relocated rather than removed, as visitation increases, campgrounds — which are already at capacity during the peak visitor season — would serve a smaller percentage of visitors who want to camp in the parks. The opportunity to camp in old-growth redwood forest might disappear or be greatly reduced. Camping at Freshwater Lagoon Spit would be eliminated, but the area's conversion to a day-use area would allow more visitors to enjoy an easily accessible beach with picnicking facilities. Freshwater Lagoon Spit would provide a generally more aesthetically pleasing and parklike initial view as visitors enter the southern entrance of the parks.

There would be no new trails in the parks other than the three that would result from the conversion of Cal-Barrel Road, Tall Trees access road, and Coastal Drive to trails. Many trails now go through sensitive resource areas; these trails would be considered for removal or relocation. Visitors could lose the opportunity to see and experience those resources (including old-growth redwood forest), and visitor experience values would be diminished. Visitors who want to see the Tall Trees Grove would have to hike a much greater distance if the road to the current trailhead was removed and converted to a trail. This would limit the experience of the Tall Trees Grove to those visitors physically able to hike this greater distance.

There are several actions under this alternative that impact automobile touring in the parks. Cal-Barrel Road, Tall Trees access road, and the Coastal Drive would be converted from low-speed scenic drives to trails. This would eliminate three low-speed scenic driving opportunities. Those visitors who are not physically able to hike or do not choose to hike would lose an opportunity to see old-growth redwoods in the Cal-Barrel Road trail conversion, and many

opportunities for scenic views of the Pacific Ocean coastline along the Coastal Drive because of conversion. During the peak visitor season, Howland Hill Road would be one-way, relieving drivers of the stress of passing oncoming vehicle traffic on the narrow redwood-lined road. Visitors at the end of the road would have to drive at least 9 miles around to the other end to enjoy the scenic drive.

Off-road vehicle use would be prohibited throughout the parks, and (except for permitted uses) after three years commercial fishermen would not be allowed to drive on RNSP beaches. This would eliminate commercial fishing from RNSP beaches, but for beachcombers, sun-bathers, and other beach users the impact would be a more natural ambiance and a safer, less stressful experience without the need to be alert for vehicles.

The reduced parking area at Stout Grove would mean fewer visitors would be able to see and experience this premiere and popular resource during peak visitation periods. Opportunities to picnic at picnic sites with tables, trash cans, and parking would be diminished by the loss of picnic sites at Crescent Beach and the potential loss of sites in the Bald Hills.

Orientation, Information, and Interpretation

The removal of the Hiouchi information center and the incorporation of its functions in the Crescent City headquarters/information center would mean visitors entering the parks from the north on U.S. Highway 199 would not receive orientation information on park destinations in the Jedediah Smith/Howland Hill Road area until after they have driven by those areas. Many visitors might decide not to retrace their route and experience those resources. The Crescent City Information Center would provide most visitor orientation services for Del Norte Coast Redwoods State Park and Hiouchi. The Crescent City facility is very small, and these additional functions and new constituencies would make

for crowded conditions inside the facility. Because the Crescent City facility has no dedicated parking area, visitors would be competing for limited on-street parking, which could be a problem during peak visitation times.

Except for the change in location and if there was no expansion of role and function, incorporating the Redwood Information Center functions into the new primary visitor center in the southern part of the parks would have little impact on visitors other than they would have to travel to a nearby location for orientation and information services.

Visitors would benefit from additional interpretation of sensitive resource sites through publications and interpretive programs. The improvements in interpretive opportunities in the Bald Hills area would increase visitors' awareness and appreciation for cultural and natural resources located there. Students at the two outdoor schools would have the opportunity to learn about the parks' cultural and natural history.

Conclusions

Opportunities for visitor use in the parks would be diminished. Visitors would have fewer opportunities to experience sensitive resources directly. Visitors entering the park from the north would have less opportunity to receive orientation and interpretation.

Cumulative Impacts

This alternative would have moderate negative impacts on both visitor use and interpretation.

SOCIOECONOMIC IMPACTS

Readers may want to refer to the "Socioeconomic Impacts" section of alternative 1 and/or the glossary where some of the terms used in the following section are defined.

Visitor Use Impacts

This alternative calls for an increased emphasis on resource preservation while continuing restoration and protection activities. Establishing a primary interpretive center would result in slightly improved access and interpretation, thereby benefiting RNSP visitors.

The concept envisioned for alternative 3 would generally have an overall minor dampening effect on visitation. Relocating the Redwood Information Center functions to a highway location outside the parks would potentially benefit visitors due to improved access (assuming that traffic moving toward a new gateway location would turn off to the right, making for a safer and easier stop for visitors entering the parks and seeking information and interpretation services) and interpretation of the parks' resources. Removing the information center at Hiouchi and using the Crescent City facility would have a minor effect on visitor use. Nonetheless, the restrictions on vehicle access to attractions at interior locations within the parks, such as the Tall Trees Grove, would tend to offset any improvements associated with establishing a new interpretive center.

Similarly, eliminating overnight camping at Freshwater Lagoon Spit would likely have a modest adverse impact on travel along the north coastal route with a corresponding reduction in RNSP visitation.

For purposes of projecting RNSP visitor use under alternative 3, it is assumed that visitor growth would be moderately less than under the no-action alternative (which was assumed to grow at a rate consistent with long-term trends or an average annual rate of growth of 2.5%), based on NPS visitation data. The likely growth rate would follow the growth pattern during the most recent 10 years (1986-96) or an average annual rate of growth of 2.3%. The starting point for the projection would be the same as used for the no-action alternative, which was based on the trend line estimated from the historical visitor use data. However, the future trend would reflect slightly

lower growth. Because additional camping facilities would not be constructed under this alternative, CDPR-based camping visitors would be expected to remain constant at about 145,000 visitors, the level estimated for 1996, as discussed in the "Affected Environment" section. Estimated visitor use during the next 20 years under alternative 3 is presented in five-year intervals in table 29.

There would be modest adverse visitor impacts under alternative 3. Mitigation onsite would include increased interpretive opportunities and improved access and circulation at a new primary interpretive center on U.S. Highway 101 or 199.

Regional Economic Impacts

Alternative 3 would have a moderate adverse impact on employment, earnings, and output, when compared to the no-action alternative. Although the tourism sector would continue to grow, it would be modestly dampened compared to historical growth patterns. Visitor interest would continue to be concentrated on the highway corridors, information centers, Lady Bird Johnson Grove, Redwood Creek, and roadside campgrounds (mostly in the state parks). The construction of visitor facilities would take place under alternative 3 and would generate economic impacts, including associated benefits and costs.

As discussed under the proposed action, construction and other development activities provide jobs and earnings for local and nonlocal workers. Visitor use would generate visitor expenditures for basic needs (lodging, meals, etc.) and education/pleasure (tours, recreational activities, etc.). Visitor expenditures would provide employment and income for workers such as hotel/motel and restaurant employees, equipment rental providers, and transportation workers. Workers in the recreation/tourism industry would be needed to operate and maintain facilities and provide visitor services. Construction activities under alternative 3 would have a total construction cost of \$8.3 million (in 1998 dollars). Because these facilities would be funded from special authorizations, through Congress or the state legislature, the parks' budgets would not be affected and incremental changes in regional economic activity would be generated. RNSP operations would be expected to increase substantially under this alternative, with staffing levels increasing by 15 full-time equivalent (FTE) positions (5 full-time and 39 seasonal positions would be added), and operating budgets would rise by \$2.1 million or about 29% above the current budgeted level. Construction would generate about 58 direct and 131 total jobs with estimated direct and total earnings of \$2.5 million and \$5.0 million, respectively, in 1991 dollars. It is likely that a substantial portion of the jobs and earnings would go to local workers. The impacts from

TABLE 29: PROJECTED VISITOR USE, ALTERNATIVE 3

Year	RNSP-Related Visits NPS Data ^a	Camping Visitors CDPR Data ^b	Total Visits
2001	537,792	145,000	682,792
2006	602,542	145,000	747,542
2011	675,088	145,000	820,088
2016	756,369	145,000	899,369

a. Based 480,000 visitors in 1996 and future growth of 2.3% per year.

b. Based on 145,000 visitors in 1996, which is assumed to be constant through 2016.

construction activities would be short term, occurring only during the construction period.

There would also be enhanced employment and income-generating opportunities associated with RNSP operations and visitor use, but less so than under alternative 2 (no action). With RNSP-related annual visitation projected at 747,542 visitors in the year 2006, the associated direct and total (including indirect and induced components) employment would amount to 1,126 workers and 2,183 workers, respectively, due to RNSP operations purchases and visitor spending within the two-county region. (This compares to an estimated increase of 1,269 direct workers and 2,413 total workers overall, under the no-action alternative, for a net 230 fewer workers than the no-action alternative.) Earnings associated with direct employment would amount to \$18.7 million, and total earnings would be \$51.6 million in 1991 dollars. These measures of economic activity would be associated with \$38.9 million in direct purchases by visitors and \$90.6 million in gross output within the region, also in 1991 dollars. It is necessary to recognize, however, that the additional regional economic activity associated with increased visitor use and associated expenditures is largely an artifact of expansion of recreation/tourism in general, not the result of specific measures undertaken by the National Park Service and California Department of Parks and Recreation under alternative 3. In effect, the increase in tourism is driven by national economic and demographic conditions and visitation trends.

There would be moderate to substantial adverse impacts on specific groups who reside in the two-county region and use RNSP resources for visitation/recreation, e.g., local visitors to Crescent Beach and commercial beach fishermen who fish for smelt and surf perch from beaches at Freshwater Lagoon Spit, Crescent Beach, and Gold Bluffs Beach. Vehicle access to the three beaches would be continued by permit only until 2001 and only permit holders with permits issued in 1996 would be eligible for renewal of their permits. No new permits would be issued. The impacts on populations groups engaged in

commercial beach fishing could be substantial following the termination of vehicle access to the fishing grounds. Similarly, impacts on redwood burl and wood carvers could be substantial as a result of prohibiting vehicle access on RNSP beaches for redwood raw materials gathering purposes. In addition, some ranchers and other agricultural workers could be impacted by NPS land acquisitions for estuarine restoration. As in the case of alternative 1, the town of Orick would be principally affected by the above alternative 3 actions.

Employment losses by some other agricultural workers as well as commercial beach fishermen and redwood burl and wood carvers could be mitigated by providing information outreach about prospective NPS/CDPR and other job opportunities and training to displaced workers.

Population and Housing Impacts

Most of the employment increases could be absorbed by the existing workforce. A few people might be induced to in-migrate to the area for work opportunities. There would be no related adverse population impacts on the region. Housing impacts would be mostly beneficial because most RNSP personnel would seek housing in nearby communities, which would help to stimulate the general housing market.

Public and Commercial Services Impacts

Most municipal services, utilities, and other facilities in Humboldt and Del Norte Counties (including the cities of Eureka, Arcata, Trinidad, and Crescent City as well as the McKinleyville, Orick, and Klamath communities) would be unaffected by implementing alternative 3. Transportation infrastructure would not be significantly affected, although traffic on Eureka and Crescent City streets and U.S. Highways 101 and 199 would be expected to increase moderately. There would be no adverse impacts on municipal services or fiscal conditions of local

governments in the two-county area generally. However, eliminating camping and overnight RV parking at Freshwater Lagoon Spit would reduce the number of visitors making overnight stays at that location and, consequently, substantially reduce the purchases of goods and services in Orick made by such visitors. The decline in economic activity in Orick could adversely impact the economy and social conditions in that community, as in the case of alternative 1. However, this would have a minor adverse effect on the fiscal condition of Humboldt County as a whole.

Utility infrastructure would not be adversely impacted. Onsite infrastructure within the parks, such as water, sewer, roads, and parking, would be enhanced only modestly as funding from normal operating sources became available.

Services provided by the private sector, such as grocery stores, restaurants, hotels/motels, RV campgrounds, banks, etc., and used by visitors would likely accrue financial benefits from increased RNSP-generated tourism, with the possible exception of reduced spending by Freshwater Lagoon Spit RV users at Orick businesses as noted above. This might lead to increased private investment in facilities that serve tourists, particularly lodging, restaurants, and recreational services and retail shopping. Mitigation for the loss of visitor business at Orick could include improved signs indicating availability of visitor goods and services; information brochures at information centers indicating the availability of local service providers, local public agency development (possibly with NPS/state support) of a new privately operated RV park and campground on public lands in the immediate vicinity of Orick, etc. The loss of recreation-related resources could be mitigated by enhancing picnic areas and related facilities at nearby locations.

Similarly, the removal of levees and the acquisition of properties in the Redwood Creek basin 100-year floodplain could result in the displacement of several ranch households and the loss of agricultural production. Land

acquisition would be based on a willing seller basis, with compensation established through fair market value appraisals.

Land Use Impacts

There could be changes in land use designation or zoning use classification due to RNSP land acquisitions for resource protection. Indirect impacts would include the modest development of tourism-related infrastructure that could be accommodated under existing land use plans and zoning ordinances. Participation in gateway community planning through the provision of technical assistance by RNSP staff would be a beneficial impact.

Impacts on American Indian Tribes

There would be modest beneficial impacts on American Indian tribes under alternative 3. NPS and CDPR staff would continue consultations with the Yurok Tribe and other American Indian tribes in the area as well as other agencies and cultural preservation interest groups related to issues of mutual concern. Cooperation with these groups would emphasize preservation issues. The Yurok Tribe would possibly develop a lodge facility as part of its economic development strategy.

Conclusion

The regional economic effects from increased spending on lodging, transportation, food, fuel, retail goods and services, etc. in the two-county area would be less than those under the no-action alternative. However, there would be beneficial short-term impacts associated with the construction of a new primary interpretive center and other development described under alternative 3. Some local groups would be adversely impacted under alternative 3, including local visitors who use the picnic area and associated facilities at Crescent Beach, commercial fishermen who engage in beach fishing at Freshwater Lagoon

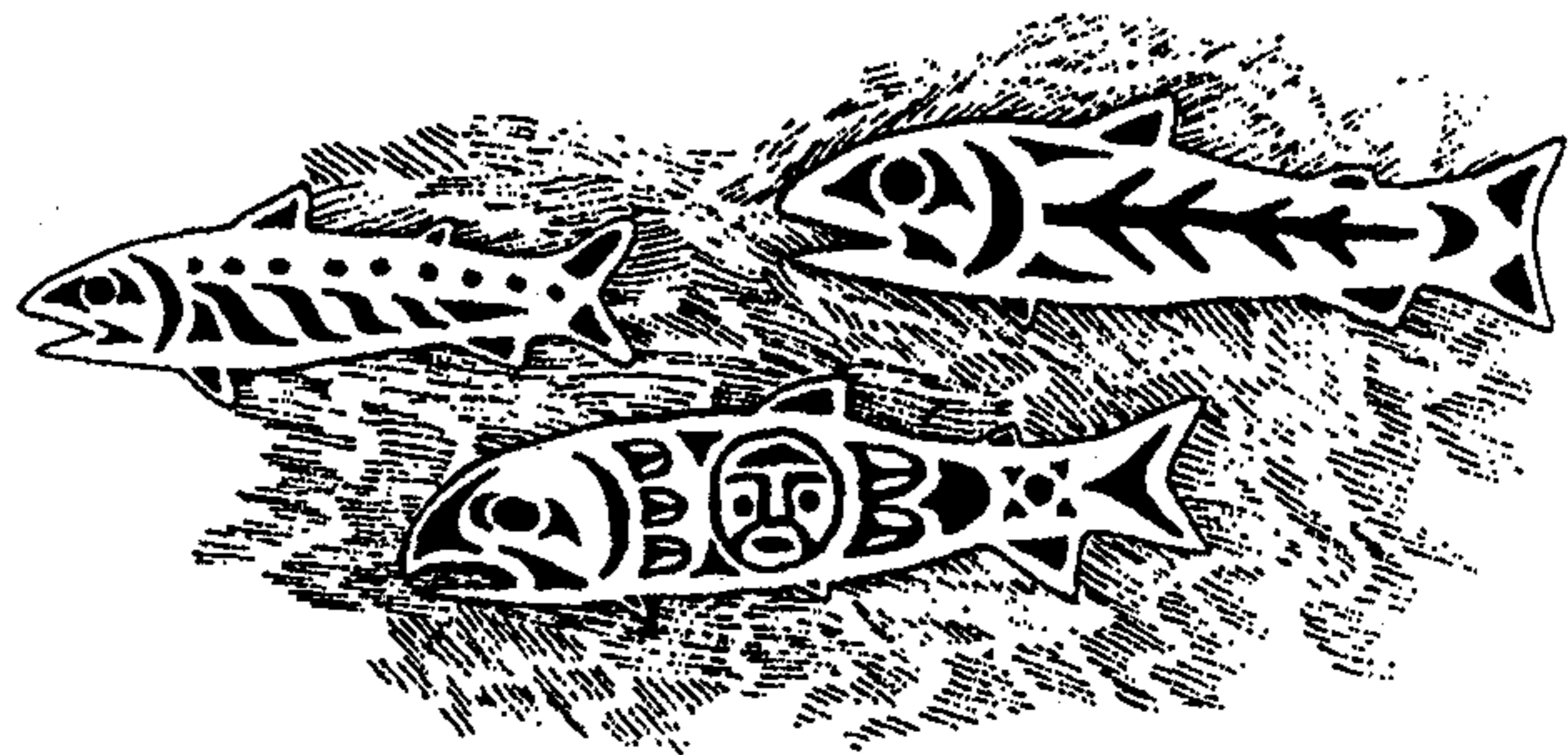
Spit and Gold Bluffs Beach, and redwood burl and wood carvers who currently use vehicles to gather redwood raw materials on RNSP beaches.

Ranch households and other agricultural workers would be displaced if land acquisitions in the Redwood Creek basin floodplain was made by National Park Service, although purchases would be on a willing-seller basis; residents might find it difficult to establish similar businesses or find employment in agricultural occupations elsewhere. There would be small beneficial effects on housing. There would be minor

adverse impacts on public services. There would be some modest beneficial impacts on land use planning due to the participation of RNSP staff in gateway community planning. Finally, there would be no adverse impacts on American Indian tribes in the area under alternative 3.

Cumulative Impacts

Please see the discussion of cumulative impacts in the "Socioeconomic Impacts" chapter of alternative 1.



IMPACTS OF IMPLEMENTING ALTERNATIVE 4

IMPACTS ON NATURAL RESOURCES

Soils

The continued use, maintenance, and management of RNSP roads, trails, parking and picnic areas, buildings, and utility systems would result in ongoing minor disturbances to soils and topography, such as erosion and soil compaction. This alternative proposes the construction of more trails, and with increased use there would be more erosion and compaction of the soils than with any of the other alternatives.

Alternative 4 would result in the greatest amount of construction-related soil erosion because there is more construction proposed than under the other alternatives. Sediment from construction projects can erode from hillslopes, enter the parks' streams, and affect vegetation, wildlife, aquatic resources, water quality, and cultural resources. The degree of impact is directly related to the location of the construction project (slope and location relative to streams), the type of soil, the amount of sediment entering the stream, and whether any aquatic habitat is affected by the sediment inputs. Minor soil disturbance and erosion could occur during the

- the construction of additional campsites and campgrounds, hiking trail connections, waysides and pullouts, and hiking, equestrian, and mountain bike trails throughout the parks
- the construction of a visitor information center in the Hiouchi area
- the relocation of the park entrance station and road at Jedediah Smith Redwoods State Park
- the construction of access and parking improvements at Tall Trees Grove, and parking improvements at Stout Grove
- the construction of a new access road and entrance station at Del Norte Coast Redwoods State Park

- the relocation of the picnic and parking areas out of the wetlands at Crescent Beach
- the construction of facilities at the Brush Dance site
- the straightening, widening, and paving of Davison Ranch-Gold Bluff Beach-Fern Canyon Road
- the paving and improvement of Howland Hill Road
- the paving and improvement of Cal-Barrel Road
- realigning, widening, and improving the Coastal Drive
- constructing restroom facilities at Freshwater Lagoon Spit

Impacts on natural and cultural resources from any construction-related activities in the parks would only be a minor impact because mitigation measures would be used to minimize runoff from construction sites.

This alternative would emphasize complete landform restoration along major roads and limited removal of minor roads on parklands in the lower Redwood Creek basin. About 155 miles of major roads would be removed, with an average of 9.5 miles of road removed per year over a period of 17 years. Roads that pose the greatest threat to resources would be treated first under this alternative. Erosion potential would be reduced at stream crossings and along all intervening major road segments through the restoration of landforms, soils, and hydrologic patterns. This landform restoration work would occur in a time period similar to alternative 1 and 3 (17 years) and nearly four times faster than alternative 2 (66 years). For a summary of the methods of treatment of abandoned logging roads, see table 2; for an illustration of the density of roads in Redwood Creek basin see the Roads in Redwood Creek Basin map.

Partial landform restoration treatments would be the same as alternatives 1 and 2, resulting in major beneficial impacts on downslope and downstream aquatic habitats, primarily in the tributaries of Redwood Creek. Over the long

term, buried topsoil would be recovered and evenly distributed on the finished surface of the completely removed roads, helping to reestablish vegetation and reducing soil erosion and sedimentation in streams — a major beneficial impact. Watershed restoration treatments would also have the beneficial impact of protecting soils and vegetation on steep slopes below the roads. Prelogging topography would be restored along the treated major roads and would improve the visual quality of the basin as roads are removed and the area is recontoured and revegetated. However, minor roads would receive only limited, partial treatment, primarily near streams. These roads would continue to disrupt natural hillslope hydrology, and vegetation would recover more slowly as little topsoil would be returned to the surface. Acceleration of the disturbed lands restoration program with this alternative would reduce the likelihood that a large damaging storm would cause catastrophic resource degradation because the restoration treatments would occur more quickly than under current conditions (alternative 2). If a major storm were to occur before completion of the restoration program, there could be localized major adverse impacts on the same resources, from untreated areas.

Depending on erosion control opportunities offered by landowners and the availability of nonpark funding sources, implementing this alternative would treat roads in the same time period as alternatives 1 and 3 (911 miles in 17 years) and much faster than alternative 2 (227 years). Where road decommissioning was undertaken, areas prone to landslides and areas with potential for delivering sediment to streams would be treated, and stream crossings would be returned to their original configuration. More roads could be treated in a shorter period of time than with landform restoration treatments, so erosion potential would decrease more quickly in the upper basin than on parklands where landform restoration treatments would be used. However, there is the possibility that road sections that were not identified as having high erosion potential and were not treated could fail after treatment was completed. This alternative

would have a moderate beneficial impact on aquatic habitats and alluvial redwood groves along the main stem of Redwood Creek upstream and within the parks.

Conclusion

The ongoing use, maintenance, and management of roads, trails, and facilities would cause minor disturbances to soils, such as soil erosion and soil compaction. There could be a minor amount of runoff and soil erosion associated with the construction of additional campsites, trails, and facilities. The watershed restoration program on parklands in lower Redwood Creek basin would emphasize partial landform restoration and would have a major beneficial impact on down-slope and downstream terrestrial, riparian, and aquatic habitats. Over the long-term, alternative 4 would greatly improve the parks' resources through the removal of abandoned roads and the restoration of landforms, soils, vegetation, and hydrologic patterns on parklands in the lower basin. However, the ecosystem impacts associated with the minor roads, which received only limited treatment throughout the basin, would continue. Upstream of the national park, road decommissioning and erosion prevention treatments would help protect aquatic habitats and alluvial redwood groves along the main stem of Redwood Creek against the immediate erosional threats from a large storm and would have a moderate beneficial impact on these resources.

Cumulative Impacts

Over the long term (decades to centuries), watershed restoration treatments on parklands in lower Redwood Creek basin and cooperative erosion control activities upstream of the parks would have a major beneficial cumulative impact of reducing soil erosion and sedimentation that have been adversely affecting downstream resources such as wildlife, water quality, vegetation (alluvial redwood groves, riparian vegetation, hillslope forests and prairies), and aquatic habitats in the tributaries and main stem of Redwood Creek.

Water Quality

Construction-related activities (road improvements and the construction of facilities) could result in minor increases in suspended sediment, turbidity, and fuels in nearby streams. Mitigation measures described in the alternatives chapter to reduce soil erosion and other discharges would lessen construction-related impacts.

Disturbed lands restoration of parklands in Redwood Creek basin would have the beneficial impact of reducing nonpoint source pollution (elevated suspended sediment and turbidity in the parks' streams) over the long term.

Ongoing water quality degradation in the lower Redwood Creek valley includes elevated levels of nitrogen and phosphorus from agricultural runoff, increased sediment loads from past and current upstream logging activities, and increased water temperatures and decreased oxygen caused by the removal of riparian vegetation. As under the no-action alternative, there are no proposed actions that would eliminate contamination from animal wastes, reestablish riparian vegetation, or remove the levees along the river, so these adverse water quality impacts would continue to occur. Impacts on water resources caused by private land uses would depend on the level of cooperation between private landowners and RNSP staff and the willingness of other agencies to apply their water resources protection programs.

Waste at existing and proposed campgrounds (at state parks, Freshwater Lagoon Spit, and remote campsites), at the two outdoor schools, and at any new facilities might have an adverse impact on water quality if not disposed of properly. Construction of restroom facilities at Freshwater Lagoon Spit would have a localized major beneficial impact on water quality because effluent would either be transferred or treated onsite. Water quality monitoring would ensure that if a water quality problem existed, it would be promptly taken care of.

Conclusion

Water quality in the lower Redwood Creek valley is being adversely affected by ranching activities, and past and present timber harvesting and would continue to contribute point and nonpoint source pollution such as turbidity and agricultural wastes into Redwood Creek. There are no actions proposed that would reduce contamination from animal wastes or reestablish riparian vegetation in the lower Redwood Creek valley, so these minor adverse impacts would continue to occur. Waste at RNSP campgrounds could cause water quality problems if not disposed of properly. Construction-related water quality impacts would be minor because mitigation measures would be employed to reduce runoff and contamination of the parks' streams.

Cumulative Impacts

Water quality would continue to be adversely impacted by the retention of the federal flood control levees and the erosion and sedimentation caused by past and current logging activities. Over the long term (decades to centuries), watershed restoration in Redwood Creek basin would have a moderate beneficial cumulative impact on the water quality in lower Redwood Creek and the estuary.

Floodplains

The levees in the lower valley (lower 3.4 miles of Redwood Creek) would not be removed and would continue to have adverse impacts on circulation and sedimentation patterns, vegetation, wildlife, and aquatic resources, but the levees would continue to protect ranchland and roads for up to a 100-year frequency flood. These impacts are the same as for the no-action alternative (alternative 2) and are presented in table 26.

When the embayment closes at the mouth of Redwood Creek in the summer, lands in the lower Redwood Creek estuary are flooded, which can prevent the use of ranching

equipment, adversely affect crops in the fields, prohibit use of the fields by ranch animals, and restrict access to properties on Hufford Road. (Hufford Road would be elevated to ensure landowner access during periods of flooding.) Woody debris left in the fields after waters recede can also interfere with cultivation and mowing. Up to 95 acres of agricultural lands and portions of Hufford Road would be flooded occasionally during the summer and fall when the sand berm closes the mouth of Redwood Creek.

Since the mid-1990s, the park's policy has been to protect salmonid habitat from the adverse effects of an uncontrolled breach. The U.S. Army Corps of Engineers approved a section 404 permit for controlled breaching of the estuary during the summer and fall low-flow periods to protect fish habitat. Controlled breaching by RNSP staff prevents the occurrence of an uncontrolled breach that could have major adverse impacts on salmonid habitat. As a condition of the section 404 permit, the Corps stated that a longer term alternative should be pursued to manage water levels in the estuary. These measures may include the setback of levees, conservation easements, the raising of the county road above flood elevation, or outright land purchase in the lower Redwood Creek valley to protect the fisheries resource.

Ongoing disturbed lands restoration would reduce the amount of sediment entering Redwood Creek and its tributaries and would assist in the recovery of downstream plant and animal communities, stream morphology, and hydrologic and biological processes. Siltation and aggradation, increased bank erosion, and channel widening in Redwood Creek basin streams would continue to occur and would lessen as roads, road benches, and stream crossings were restored. The erosion potential of treated roads would be eliminated upon completion of the watershed restoration program, even though the downstream effects of these treatments may take decades to centuries to fully occur.

Conclusion

This alternative would continue to have a major adverse impact on water circulation and sedimentation in the Redwood Creek estuary. Elevating Hufford Road and retaining the levees would have the beneficial impact of protecting private property and current land uses, but would adversely affect river processes and conditions in the lower valley. Dredging the sloughs would temporarily increase turbidity and reestablish historic depths in the estuary.

Cumulative Impacts

There would be continued major adverse impacts on physical and biological processes, natural resources, and water quality in the lower Redwood Creek valley and estuary from the presence of the federal flood control levees. Over the long term, watershed restoration upstream and within the national park would have a major beneficial impact on the main stem and tributaries of Redwood Creek.

Wetlands

Impacts of Watershed Restoration

As in alternative 1, this alternative would have long-term benefits on riverine and palustrine wetlands in all drainages where landforms are restored and roads removed or treated to reduce erosion. Under both methods of treatment, primary hydrologic patterns would be restored. The greatest benefit to these wetlands would occur in those areas in which the landforms are completely restored to original conditions. Long-term benefits to wetlands downslope of areas where drainage patterns continue to be altered by the presence of logging roads would not be as great, because the failure of some road segments is inevitable.

In those watersheds where some road segments are not completely removed, the possibility for landslides to occur from some untreated road sections would continue to threaten downstream

and downslope riverine and palustrine wetlands. The potential for adverse effects from landslides that could alter drainage patterns and destroy vegetation and wildlife in and adjacent to stream channels would be reduced, a long-term beneficial impact.

Impacts of Estuary Restoration

Under this alternative, there would be no restoration of the estimated 75% of estuarine habitat in the Redwood Creek estuary that has been lost through channelization, draining, diking, and infilling of the estuary and sloughs. No portion of the levees would be removed under this alternative, and no wetland would be restored as a direct result of partial levee removal. Alteration of estuary circulation and flow that began when portions of the estuary were diked and drained for residential and agricultural development and when the flood control levees were constructed in 1968 would continue. The reduction in flow and circulation from the levees combined with the delivery of high volumes of sediment from industrial activities upstream would continue to reduce the depth of portions of the estuary. These would be considered adverse impacts on wetlands associated with the estuary.

Long-term adverse impacts on anadromous salmonids from habitat reduction and alteration to food sources would continue in the estuary. Habitat for the tidewater goby would continue to be less than under original estuary configuration and circulation patterns. Occasional severe adverse impacts on fish would result from illegal uncontrolled breaching. These are indirect adverse impacts on wetlands, because fish habitat is one of the major functions and values of the Redwood Creek estuary.

Impacts of Second-Growth Forest Management

There would be very minor localized indirect short-term adverse impacts on intermittent and perennial stream channels adjacent to second-growth forests that would be managed under this alternative; these impacts would be from runoff of disturbed soils if heavy equipment was used

to remove downed trees or from the burning of slash adjacent to stream channels. This alternative would have fewer short-term adverse impacts and fewer long-term indirect benefits to intermittent and perennial stream channels from restoring natural vegetation patterns because second growth would be managed only in areas where visitor use and enjoyment would be increased through such management.

Impacts Related to Artificial Impoundments

There would be no short-term direct adverse impacts on 10 to 15 acres of forested wetlands from draining the ponds at Marshall Pond and Lagoon Creek. The value of Richardson Creek as habitat for coho salmon and other anadromous fish would continue to be less than if the stream was restored to original condition, which would be a negative effect on wetlands. Visitors would continue to enjoy birdwatching at Marshall Pond and the Lagoon Creek pond. The recreational value of wetlands from bird watching and fishing at Lagoon Creek would be retained, which would be a positive effect on wetlands.

Impacts Related to Visitor Use

This alternative would result in an increase in adverse impacts on wetlands at stream crossings and in floodplains and riparian areas of the Smith River and Prairie Creek because a greater number of new campgrounds, campsites, and trails would be constructed than under other alternatives; also, no campsites would be removed.

Relocating the road, parking, and restrooms from Crescent Beach picnic area would result in the restoration of 0.5 acre of coastal palustrine wetland. New construction would be located out of wetlands.

Impacts of Vehicles on Beaches

There would be direct adverse impacts on wetland areas at the Redwood Creek estuary or in the coastal streams that drain into the ocean at Gold Bluffs Beach if vehicles drove through

these areas for visitor or commercial fishing access. These impacts would be anticipated to be *minor short-term impacts* because winter storms and seasonally high tides, in combination with heavy rainfall and subsequent high creek and stream flows, erase traces of vehicle use. Auditory and visual intrusions into the natural scene would be a direct adverse impact on the aesthetic value of sandy shoreline and estuarine wetlands at Freshwater Lagoon Spit beach, and on the sandy shoreline wetland at Gold Bluffs Beach.

Impacts Related to Circulation and Access

Primary wetland functions that would be affected by road removal and reconstruction and improvements would be anticipated to be wildlife habitat, aesthetics, and water quality enhancement. There would be minor long-term improvement to adjacent wetlands from reducing erosion and runoff from graveled roads and pulloffs; however, petroleum leakage from an increased number of motor vehicles would continue to adversely affect water quality in wetlands and drainages adjacent to Davison Road- Gold Bluffs Beach road, Cal-Barrel Road, Howland Hill Road, and the new entrance road to Del Norte Coast Redwoods State Park.

Widening, straightening, and paving Davison Road-Gold Bluffs Beach Road to Fern Canyon would likely adversely affect a maximum of 2.4 acres of riverine and palustrine wetlands.

Paving and improving Cal-Barrel Road would result in significant short-term adverse impacts on stream channels and isolated wetlands from grading, dredging, and filling required for road widening and realignment. The primary long-term impact would be a slight increase in the area of wetland affected by the placement of the road and drainage structure. A new road would be constructed with adequate drainage that would reduce the potential of major failure, which would have potentially significant adverse impacts on Boyes and Brown Creeks. This would be a long-term benefit.

Paving and providing more pullouts along Howland Hill Road would result in short-term adverse impacts on stream channels and isolated wetlands from grading, dredging, and filling. The primary long-term adverse impact would be a slight increase in the area of wetland affected by the placement of the road and drainage structure. Significant adverse impacts on wetlands from widening Howland Hill Road would not be anticipated because major widening would require the removal of large redwood trees, which would be an unacceptable adverse impact. It is anticipated that adequate drainage would be provided as part of the road improvement, which would reduce the potential of major road failure. This would be a long-term benefit by reducing the threat to Mill Creek.

Improving the access road to the Tall Trees Grove would result in moderate to significant short-term adverse impacts on stream channels and isolated wetlands from the grading, dredging, and filling required for road widening and realignment and parking lot improvements. This alternative would likely result in a slight increase in the area of wetland affected by the road. The road would be constructed with adequate drainage that would reduce the potential of major failure, which would have potentially significant adverse impacts on Redwood Creek via its tributaries. This would be a long-term benefit.

Providing alternative access to Mill Creek campground via a new Del Norte Coast Redwoods State Park entrance road would result in significant short-term adverse impacts on stream channels and isolated wetlands from the grading, dredging, and filling required for road construction. A new road would be less steep but would need to be longer. The primary long-term adverse impact would be an increase in the area of wetlands affected by the new road. A new road would have a long-term indirect benefit for wetlands if constructed with adequate drainage to reduce the potential of major failure into the drainage of the West Branch of Mill Creek.

Realigning and widening the Coastal Drive would result in moderate to significant short-term adverse impacts on stream channels and isolated wetlands in coastal drainages from the grading, dredging, and filling required for road widening and realignment. This alternative would likely result in a slight increase in the area of wetland affected by the road, but the total area affected would depend on the alignment chosen. Reconstructing the road on the existing road bench would have fewer impacts than constructing a new bench. A new road would have a long-term benefit from being constructed with adequate drainage, which would reduce the potential of major failure.

Impacts of Education and Interpretation

There would be a minor benefit for sandy shoreline and estuarine wetlands at the Redwood Creek estuary when the Redwood Information Center functions were moved to the new visitor center, the building was salvaged, and the site was returned to day use.

Conclusion

There would be major long-term benefits for intermittent and perennial stream channels immediately downstream from areas where watershed restoration occurred. Primary drainage patterns would be reestablished, with major benefits where riverine wetlands were re-created after uncovering original channels. Other downstream wetlands would benefit indirectly from the restoration of natural drainage patterns.

Implementing this alternative would result in little or no increase in the amount of wetlands associated with the estuary. The present extent and configuration of the wetlands associated with the estuary would be retained. Channel dynamics and circulation patterns would continue to be adversely affected by configuration and drainage structures of the levees.

There would be fewer indirect long-term benefits for intermittent and perennial stream channels from managing second-growth forest under this

alternative because second-growth forests would only be managed in those areas where visitor use and enjoyment would be increased through such management.

Adverse impacts on wetlands adjacent to roads and stream crossings would result from the road widening, realignment, and paving of Davison Road and Gold Bluffs Beach Road; Cal-Barrel Road; Howland Hill Road, Tall Trees access road; Del Norte Coast Redwoods State Park entrance road (Mill Creek campground road); and the Coastal Drive. A larger area of wetland would be affected than under the no-action alternative because new roads would be wider and would have more pullouts constructed. Realignment might require that larger areas of wetland be filled to provide the necessary vertical grade.

There would be a negative effect on the aesthetic values of sandy shoreline, estuarine, and riverine wetlands from vehicle use on Freshwater Lagoon Spit beach and Gold Bluffs Beach.

This alternative would result in minor to moderate negative effects on wetlands from construction, use, and maintenance of a greater number of campgrounds, primitive campsites, and trails, depending on the amount of new facilities constructed. The negative impacts on wetlands would be greater under this alternative than other alternatives because more construction would occur under this alternative.

Cumulative Impacts

There would be moderate cumulative benefits for wetlands from watershed restoration within and upstream of the parks. This alternative would have moderate long-term adverse impacts on the wetlands associated with the estuary.

Restoring Crescent Beach wetlands and removing the Redwood Information Center would result in a minor positive cumulative effect on coastal wetlands. There would be moderate cumulative negative effects on wetlands under this alternative from the retention of other facilities within wetlands, the construction of new

trails and camping areas, and the improvements to public roads.

Threatened and Endangered Species

Impacts Related to Watershed Restoration

Impacts on threatened and endangered species from watershed restoration conducted under this alternative would be the same as under the proposed action. Watershed restoration conducted under this alternative would result in long-term benefits for coho salmon and other anadromous fish by reducing the volume of sediment delivered into spawning streams. Where the potential for landslide erosion was not identified during field investigations prior to restoration, untreated road segments might pose a long-term threat to these fish because failures would result in sedimentation and continued impacts on spawning habitats. Additional failures of road segments over time would affect the regenerating forests on landslide areas, which would slightly reduce future marbled murrelet and spotted owl habitat.

Short-term benefits for these fish would be greater than under alternative 2 because roads that pose the greatest threat to sensitive resources would be treated first. Long-term benefits for coho salmon, steelhead, owls, and murrelets would be greatest in those areas where roads were completely removed because there is less chance that a potential landslide site would be overlooked during field investigations. Forest fragmentation would decrease in restored areas over 200 years but the forest patches on the abandoned roads would not regain the characteristics of mature forest outside the road corridors because of the lack of topsoil on abandoned roadbeds and lack of plant nutrients in road and cutbank surfaces.

Impacts of Estuary Restoration

Under this alternative, as under the no-action alternative, direct adverse impacts on juvenile coho salmon and other anadromous fish, and on tidewater goby habitat from breaching of the

sandberm at the Redwood Creek estuary, would be minimized to the greatest extent possible by controlling the timing, depth, and location of breaching when trying to prevent the negative effects of a natural uncontrolled breaching event. The greatest potential for direct adverse impacts would exist in the summer when juvenile salmonids are present in the estuary. Direct adverse impacts on juvenile salmonids result from fish being entrained in the outflow of estuarine waters into the ocean, where smaller fish are less able to escape predators. The later in the season breaching was performed, the less adverse the impact, because juveniles are larger and have had more time to adjust physiologically for the transition from freshwater to salt water.

Impacts of Second-Growth Forest Management

This alternative would result in greater short-term adverse impacts and fewer long-term benefits for northern spotted owls and marbled murrelets than other alternatives because it would result in the treatment of second-growth forest lands primarily to enhance visitor use and enjoyment in those areas rather than to meet resource management strategies. Benefits to owls and murrelets from regrowth of second-growth forest would be realized over several hundred years, the same time period as the no-action alternative.

Impacts of Prairie Restoration

Prairie restoration that is accomplished through the use of prescribed fire would result in minor direct short-term impacts on northern spotted owls and marbled murrelets if smoke drifts into forest stands occupied by these birds. Forests around prairies and forest openings selected for restoration would be surveyed for the presence of owls and murrelets during project planning. Adverse impacts on these birds would be avoided to the greatest extent possible by conducting burns outside the nesting seasons. Fire prescriptions would be established to avoid major adverse impacts from drifting smoke. Prescriptions to reduce smoke impacts would

include actions such as adhering to air quality standards for burn days.

Some trees would be removed for restoration or maintenance of forest openings. Removing trees might adversely affect murrelets or owls if the location of the prairie or forest opening is in or near suitable nesting habitat for these birds. The removal of trees greater than 18 inches in diameter would adversely affect northern spotted owls. RNSP staff would consult with the U.S. Fish and Wildlife Service on all proposals for prairie restoration that have the potential to affect owls, murrelets, or other listed species. Prescriptions for restoration would be modified based on the results of these consultations to avoid or minimize adverse effects on listed species to the greatest extent possible.

Impacts of Fire Management

This alternative would result in a slight long-term increase in the potential for large fires throughout the parks and associated disturbance from equipment and personnel, and a long-term adverse impact on vegetation communities from removing a natural ecological process in the parks' ecosystems. This adverse impact would be greatest in the knobcone pine vegetation type in the Little Bald Hills because that vegetation type depends on fire for regeneration. Alluvial stands of redwood forest and riparian communities along the major rivers and streams would be least affected by fire suppression because these vegetation types are likely to have evolved without fire playing a major role. The removal of fire as an ecosystem process would have moderate long-term indirect adverse effects on threatened and endangered species that inhabit RNSP ecosystems.

Large damaging fires would have direct major adverse impacts on marbled murrelets, murrelet critical habitat, northern spotted owls, coho salmon, and other anadromous fish from the destruction of habitat both by fire and by suppression activities that would be required on a large scale.

Impacts Related to Artificial Impoundments

There would be minor indirect adverse impacts on coho salmon and other anadromous fish in Richardson Creek from 1,500 feet less of available spawning habitat if the dam at Marshall Pond were retained.

Impacts Related to Visitor Use

This alternative would result in the greatest long-term adverse impacts on northern spotted owls and marbled murrelets from noise and disturbance from construction of new hiking, horse, and mountain biking trails, and camping areas, and from increased visitor use in sensitive habitats. A minimum of 69% of old-growth forest would be within 0.25 mile of a road, trail, or facility.

Providing more primitive campsites would increase disturbance in relatively untouched areas of the parks, so the incremental impact would be greater than adding sites in areas that already generate noise and disturbance. The amount of disturbance would be proportional to the increase in trail mileage. New trails through old-growth forest would have a much greater adverse effect than trails through second-growth forests that are regrowing and are not yet suitable owl or murrelet habitat.

Impacts of Visitor Access and Circulation

Paving, widening, and straightening Cal-Barrel Road, Davison Road, Howland Hill Road, Tall Trees access road, and the Coastal Drive would increase visitation and/or required maintenance in old-growth forests or within 0.25 mile of old-growth forests. Increased visitation in some of these areas would result in moderate adverse impacts on northern spotted owls and marbled murrelets.

Conclusion

This alternative would result in a moderate positive long-term effect on coho salmon and other anadromous fish from watershed restoration within and upstream of the parks. A major

direct adverse impact on tidewater goby habitat and a moderate adverse impact on juvenile coho salmon and other anadromous fish in the Redwood Creek estuary from habitat destruction and alteration due to channelization by the levees would continue.

Fire suppression would result in indirect long-term adverse impacts on threatened and endangered species from removing a natural process in the parks' ecosystems.

Under this alternative, increased visitation to the parks would be promoted and new facilities would be constructed. This would result in additional noise and disturbance in some areas that are suitable nesting habitat for northern spotted owls and marbled murrelets. Construction and maintenance activities would be conducted in such a manner and at such times as to avoid adverse impacts on listed threatened and endangered species. Several acres of critical habitat for marbled murrelets would be removed for road improvements on Cal-Barrel Road, Howland Hill Road, and Coastal Drive. Visitor use would increase in old-growth forests as a result of new trail and campground construction. The paving of Cal-Barrel and Howland Hill Roads, and increasing access to the Tall Trees Grove would be expected to substantially increase visitor use in old-growth forests. Visitor use would indirectly affect owls and murrelets through increased disturbance in suitable nesting habitat. Improvements and paving of roads in old growth would result in direct adverse impacts on marbled murrelet critical habitat from tree removal and habitat alteration.

Cumulative Impacts

The overall effect of proposals under alternative 4 would be a minor to moderate cumulative negative effect on marbled murrelets and northern spotted owls due to increased development and use of old-growth forests within the park from the construction of new trails, campsites, and paved roads. The effects on coho salmon and other anadromous fish from watershed restoration would be a moderate

cumulative benefit obtained from improved water quality and increased suitable habitat.

IMPACTS ON CULTURAL RESOURCES

New facilities — a visitor center in the vicinity of Mill Creek campground; the Del Norte Coast Redwoods State Park visitor center and entrance station, and the Hiouchi area visitor center; trails; picnicking and campsites; and wayside exhibits) would be sited to avoid adversely impacting known cultural resources, including potential cultural landscapes.

Salvaging the nonhistoric Redwood Information Center and converting the surrounding area to day use — including beach access, boardwalks, and wayside exhibits — as well as removing the nonhistoric Hiouchi information center would have no impact upon the parks' cultural resources.

Before realigning and widening the Coastal Drive, the effects on the National Register property would be evaluated in consultation with the California state historic preservation officer and the Yurok tribal historic preservation officer. Before improving and paving the Cal-Barrel, Davison/Gold Bluffs Beach, and Howland Hill Roads and the Tall Trees access road, each road's eligibility for inclusion on the National Register of Historic Places would be evaluated after following applicable consultation procedures.

Expanding and enhancing the RNSP curatorial program would improve the preservation, research, and interpretation of the parks' collections. In addition to better preserving museum artifacts and archival materials, the curatorial program would improve recordkeeping and the retrieval of information pertaining to the management and administration of the parks. However, increased access to and use of the collections by RNSP staff could result in the loss of artifacts or archival material due to unsupervised or inappropriate use.

Conclusion

The fourth alternative presents a less comprehensive and integrated approach to resource management, interpretation, and visitor services than does the preferred alternative. Cultural resources would face increased impacts from escalating levels of use, because many of the potential impacts on cultural resources would correspond directly to increases in visitor use associated with expanded development and additional visitor services and concessions. Sensitive cultural resources would continue to be susceptible to damage from visitor use. With appropriate mitigation, however, there would be few, if any, adverse impacts on cultural resources.

Cumulative Impacts

Cumulative impacts would result from the continued visitor use of campsites and hiking and mountain biking trails in sensitive cultural resource areas, as well as from increased access to and visitor use of the parks' collections. It is possible that cultural resources outside of the boundaries of Redwood National and State Parks have been destroyed or damaged in the past by either nonfederal or nonstate actions. Most actions proposed in this joint plan fall under the auspices of federal preservation laws, as well as the California Environmental Quality Act, which provide legal protection for cultural resources. However, actions occurring outside of the parks' boundaries, such as watershed restoration or the construction of a nonfederally funded visitor center, could adversely impact cultural resources not afforded the protection of federal or state law.

Cumulatively, cultural resources would benefit from the following:

- Assistance that could be provided to protect cultural resources affected by watershed restoration.
- The removal of noncontributing, intrusive features from the parks' cultural landscapes.

- Increased public understanding of and sensitivity to the importance of the parks' cultural resources.
- An expanded and enhanced curatorial program.

IMPACTS ON VISUAL QUALITY

Due to the inherent visual sensitivity of landforms and land cover within this region, watershed and vegetation management actions under this alternative could result in appreciable impacts on visual resources. Impacts would be most visible on forested and open hillsides as well as open flat areas. In this alternative, restoration activities would focus on disturbed lands near and visible from high visitor use areas. Disturbed lands restoration activities altering terrain or vegetation could impact the line, form, color, texture, and visual density of the landscape. Impacts would affect visual experiences in both micro and macro landscapes. Because of the emphasis on high visitor use areas, most actions would probably be highly visible, with some negative visual impacts. These impacts would most likely become visual benefits over time.

Within visually sensitive areas, management actions intended to increase development and encourage additional visitor use of cultural resources would result in some visual impacts. Most negative visual impacts could be mitigated. However, overall visual quality would greatly depend on project-specific visual analysis and design.

Visitor use and interpretive actions strongly influence observers. Visual quality would greatly depend on project-specific development activities. An increase in negative visual impacts associated with visitor use and interpretive activities would occur.

Removing, relocating or enlarging access roads, parking areas, trailheads, and associated facilities in visually sensitive areas could result in short-term negative visual impacts primarily affecting

micro landscapes. Providing additional hiking, equestrian, and mountain biking trails as well as picnic and camping facilities could result in short-term visual impacts, primarily affecting the micro landscape. However, these facilities would also enhance landscape viewing opportunities. Depending on placement, increased pullouts and waysides and selected viewsheds could have a beneficial impact, creating an appreciable increase in macro landscape viewing. Overall visual quality would greatly depend on project-specific visual analysis for all actions resulting in the removal, relocation, or development of visitor use and interpretive facilities.

Coastlines and coastal environments are highly sensitive visual resources due to intensive dynamic contrasts and extensive viewsheds. Restricting overnight vehicle camping to the north end and eliminating tent camping from the beach at Freshwater Lagoon Spit would continue some of the existing negative visual impacts on the area's natural character, but fewer than under alternative 2.

Acquisition related to viewshed protection and acquisition of lands with significant scenic value would greatly enhance the preservation of regional landscape character. Identifying and protecting visual/scenic resources along highway corridors and roads could result in substantial long-term visual benefits. Negative visual impacts could result from road widening, realigning, and related maintenance activities.

Conclusion

Under this alternative there would be moderate to possibly major negative impacts on visual and scenic resources. Most long-term negative impacts would be associated with increased visitor activities and use levels, extensive development of recreational facilities and roads, and allowing restricted camping in coastline areas. Other negative impacts would be short term and would ultimately result in long-term visual benefits. Overall visual and scenic quality would directly depend on project-specific visual

analysis studies and design implementation. Harvested areas in Redwood Creek basin would be restored first and over time, the lower basin would become more aesthetically pleasing and have a more natural appearance for park visitors. Revegetation of the area would occur soon after restoration activities were completed, but restoration of the visual appearance of an old-growth redwood forest would take decades or more to occur, a minor beneficial impact. Viewshed protection actions would enhance landscape character and result in major long-term visual and scenic benefits.

Cumulative Impacts

Cumulative visual and scenic impacts include those previously occurring within and surrounding RNSP properties as well as those identified under this alternative. Previous land use activities have impacted the indigenous visual character of virtually all landscape units. The major negative cumulative visual impacts of the highly visible, extensive timber harvesting, road and highway alignments, and other development activities remain highly visible throughout the region. Under this alternative, increasing visitor activities and use levels, the extensive development of recreational facilities, and allowing restricted vehicle camping in coastline areas would have a major, cumulative, long-term negative impacts on visual and scenic resources. Watershed restoration activities and viewshed protection actions would have a cumulative long-term beneficial impact on visual and scenic resources.

IMPACTS ON VISITOR ACCESS AND CIRCULATION

Impacts on circulation under alternative 4 would be major. The internal roads (Cal-Barrel Road, Howland Hill Road, Davison Road, Tall Trees access road, etc.) would be paved and widened. This change would result in more vehicles on the roads. Parking areas associated with these areas would also be paved and widened. Additional

ENVIRONMENTAL CONSEQUENCES

facilities such as restrooms, parking facilities, and new trails and trailheads would be required. Additionally, it would allow access to larger vehicles such as buses and motor homes.

Because the areas near improved roads would be easier to access, increased pedestrian activity would also occur. Negative impacts relating to increased human use could be expected. Trash, vegetation trampling, and informal trail development are a few of the impacts that could be expected.

There would be circulation impacts due to increased traffic near the off-site visitor center, the new small visitor center near the Mill Creek campground, and the new Hiouchi information center (as per the proposed action).

IMPACTS ON THE QUALITY OF THE VISITOR EXPERIENCE

Visitor Use Opportunities

Visitors would have maximum access and use of sensitive natural and cultural resources to the extent that those resources were not irreparably damaged. Visitors would have the opportunity to experience a broad spectrum of the parks' resources as long as RNSP values were retained.

The new primary visitor center would provide visitors with opportunities to learn about the parks' significant resources and related primary interpretive themes at a much more comprehensive level than the introductory information currently available at the parks' visitor facilities. The use of a variety of interpretive media would lessen visitors' dependence on direct interaction with trained interpretive staff to provide in-depth interpretation and would accommodate the different learning styles and preferences of individual visitors. The location outside the parks might not provide the kind of direct connection between the interpretive messages and the resources being interpreted that a site inside the parks would provide. Because RNSP staff would be working with a cooperating partner, the

parks' own interpretive stories might have to share space and visitor attention with other local or regional interpretive initiatives.

Visitors would have more camping opportunities than under alternatives 1 and 3. During peak visitation periods, fewer visitors would be forced to seek camping outside the parks. Additional campgrounds would give visitors more choice and flexibility in deciding where in the parks they want to camp and would moderate crowding at individual campgrounds. Visitors who wanted a primitive camping experience would have more choice and flexibility in their campsite selection. More visitors would be able to picnic at Crescent Beach and the Bald Hills.

More trails and more trail connections for all types of trail users would give visitors greater access to RNSP resources and allow visitors more flexibility in choosing and planning trail experiences to meet their own needs and desires. Regional trail connections and a regional trails system would allow trail users to expand their experiences from the parks to even more trail opportunities outside the parks.

Camping opportunities at Freshwater Lagoon Spit would be reduced, and the camping experience would be more traditional and parklike. Visitors would have to pay a fee for camping, which would limit the use of the area to those visitors who could afford the fee. The camping experience would be more formal. For most visitors, the provision of restrooms and water would improve the quality of the camping experience.

Visitors would no longer be able to drive their vehicles on Freshwater Lagoon Spit or Crescent Beach. The positive benefit of this action would be that beach users would see and have to deal with fewer vehicles on those beaches (commercial fishermen would still be allowed vehicular access to the beaches, but their numbers would be restricted).

Many more visitors would have access to the Tall Trees Grove. The experience in the grove

would be more crowded and social. Visitors access to the grove would only be limited by their physical ability to hike from the parking area to the grove and back.

Newton B. Drury Scenic Parkway would continue as a through road, allowing some local casual and commuter traffic to mix with park-specific traffic, making the road more congested and less parklike than if the road was closed to through traffic. The driving experience on other scenic park roads (e.g., Cal-Barrel Road, Howland Hill Road, and Coastal Drive) would be improved with paving, widening, and more pullout opportunities. Enlarging the parking area at Stout Grove would increase the numbers of visitors in the grove and, especially during peak visitation periods, the experience would be more crowded and social.

Orientation, Information, and Interpretation

The expansion of orientation and information facilities at Hiouchi would give visitors entering the park from the north on Highway 199 the opportunity to receive a more thorough orientation to the parks and their resources and available activities. Better oriented, more knowledgeable visitors would be more likely to make choices that disperse their use of the parks and might lead to fewer impacts on individual resources. Visitors would be less likely to miss park destinations and attractions because of the lack of information. This expanded facility would also provide visitors with more in-depth interpretive messages about RNSP resources and primary interpretive themes than would be possible in the current facilities.

The new visitor center at Mill Creek campground in Del Norte Coast Redwoods State Park would provide visitors to that section of the parks an opportunity for park orientation and information services that was not available before. Incorporating the functions from the Redwood Information Center into the nearest interpretive facility in the southern end of the

parks would have little impact on visitors. Visitors would receive better orientation services throughout the parks as directional signs, bulletin boards, and orientation kiosks were upgraded.

Expanding the use of the outdoor schools to allow use by community and education groups in the summer and winter would increase the educational opportunities in the parks. Expansion of the education program would allow the program to benefit more students.

Because of increased access to sensitive resource areas, many interpretive experiences would occur in the resource where, for most visitors, those experiences could have the most effect — providing a direct connection between resources and their significance. Visitors would have opportunities to see demonstrations of traditional crafts and folkways from several cultures at sites within the parks where these activities have a connection to that culture. Visitor understanding and appreciation of RNSP natural and cultural resources would be improved as facilities were expanded to provide more interpretation.

Conclusions

This alternative would significantly increase the number of opportunities for visitor use and visitor access to resources in the parks. The parks' attractiveness as a primary tourist destination would increase. The increase in visitor use opportunities, coupled with expanded opportunities for visitors to become aware of those opportunities, would increase both the number of visitors in the parks and the time they spend in the parks. Visitors would have more opportunities to increase their knowledge, understanding, and appreciation of RNSP resources and primary interpretive themes.

Cumulative Impacts

This alternative would have a very positive impact on visitor use and visitor experience and

a moderately positive impact on the visitors' opportunities for orientation and interpretation.

SOCIOECONOMIC IMPACTS

Readers may want to refer to the glossary and/or the "Socioeconomic Impacts" section of alternative 1 where some of the terms used in the following section are defined.

Visitor Use Impacts

The intent of alternative 4 is to emphasize a broad range of visitor activities while focusing on preserving and protecting natural and cultural resources over restoration activities. In general this alternative is the same as alternative 1, the proposed action, but with more visitor developments and services available.

The improvements envisioned under alternative 4 would be expected to attract substantial numbers of visitors to the parks, beyond the historical levels and growth trends suggested under the no-action alternative. Similar to the proposed action, it is assumed that a destination lodge would be developed by the turn of the century, which is a planning assumption for the purposes of analysis, and that the lodge would be at a site that would allow easy walking access to the RNSP trail system. For purposes of projecting RNSP visitor use under this alternative, it is useful to consider the likely growth in visitation associated with improvements proposed under this alternative, which are somewhat more extensive than under the other alternatives, particularly in regard to road access/circulation. However, proposed improvements would generally be similar to the proposed action and thus would be expected to result in moderately higher increases in visitor use than under the proposed action.

For purposes of projecting RNSP visitor use under alternative 4, it is assumed that visitor growth would be substantially greater than under alternative 2, the no-action alternative, which was assumed to grow at a rate consistent with

long-term trends or an average annual rate of growth of 2.5%). The likely growth rate would basically follow the growth pattern during 1990-96, however, with upward adjustment of 10% for an average annual rate of growth of 3.85% (3.5% x 1.1). Also, a lower growth rate (1.8%) would be applied to project campground visitors, similar to the procedure used in projecting visitor use under the proposed action.

In addition, lodging guests at the proposed destination lodge facility would be included in the projections (also similar to the procedure used for the proposed action). Again, the starting point for the projection would be the same as used for the no-action alternative, which was based on the trend line estimated from the NPS historical visitor use data. However, the future trend would reflect substantially higher growth. Visitor use during the next 20 years under alternative 4 is presented in five-year intervals in table 30.

Regional Economic Impacts

Alternative 4 would have a substantial beneficial impact on employment, earnings, and output. The tourism sector would experience healthy long-term growth, increasing moderately above recent (1990-96) historical patterns. Visitor interest would continue to be concentrated on the highway corridors, existing and new information centers, Lady Bird Johnson Grove, Redwood Creek, and campgrounds and picnic areas. There would also be considerable visitor interest in RNSP interpretive programs that focus on both natural and cultural resources. Backcountry use of hiking, mountain bike, and equestrian trails and primitive camping areas would also expand under alternative 4. Finally, the proposed destination lodge would attract numerous visitors seeking accommodations as well as recreation and education opportunities.

The construction of new visitor facilities would be significant under alternative 4, resulting in substantial regional economic activity. These activities would amount to total construction

TABLE 30: PROJECTED VISITOR USE, ALTERNATIVE 4

Year	RNSP-Related Visits, NPS Data ^a	Camping Visitors, CDPR Data ^b	Lodge Visitors	Total Visits
2001	579,792	158,529	10,969	738,321
2006	700,331	173,319	13,068	886,718
2011	845,930	189,490	13,800	1,049,220
2016	1,021,798	207,169	14,040	1,243,007

a. Based on 480,000 visitors in 1996 and future growth of 3.85% per year.
 b. Based on 145,000 visitors in 1996 and future growth of 1.8% per year.

costs of \$68.8 million (in 1998 dollars). (This figure exceeds the total in appendix A because it includes the development of a privately funded lodge that would be encouraged under this alternative and the new GSA-built southern operations center in or near Orick.) Because these facilities would be funded from special authorizations, through Congress or the state legislature, they would generate incremental changes in regional economic activity.

The proposed destination lodge would be developed and operated through a cooperative arrangement with other public or private partners. Construction funds would come from non-RNSP sources. Construction costs for the facility would be estimated at \$30 million in 1998 dollars. RNSP operations would be expected to change, with staffing levels increasing by 25 full-time equivalent employees and funding increasing by \$1.6 million or 23%.

Construction would generate about 502 direct and 1,056 total jobs, with estimated direct and total earnings of \$23.5 million and \$43.6 million, respectively, in 1991 dollars. It is likely that a substantial portion of the jobs and earnings would go to local workers. The impacts from any construction activities would be short term, occurring only during the construction period.

With RNSP-related annual visitation projected at 886,718 visitors in the year 2006, along with a substantial (18%) increase in RNSP operations staffing, the associated direct and total (including indirect and induced components) employment

would amount to 1,429 workers and 2,711 workers, respectively, due to visitor spending and RNSP operations within the two-county region. (This compares to 2,413 total workers estimated for the no-action alternative in the year 2006.) Earnings associated with direct employment would amount to \$24.0 million; total earnings would be \$63.6 million. These measures of economic activity would be associated with \$46.5 million in direct purchases by the National Park Service for operations and RNSP visitors and \$109.0 million in gross output within the region. Much of the additional regional economic activity associated with increased visitor use and associated expenditures would be due to the influence of general growth in recreation/tourism in addition to the specific measures undertaken by the National Park Service or California Department of Parks and Recreation under alternative 4. As stated before, RNSP employment would be expected to increase by about 25 FTE positions under this alternative.

Allowing commercial beach fishing to continue at Freshwater Lagoon Spit, Gold Bluffs Beach, and Crescent Beach by permit only would result in no impacts on the affected population groups within the region.

Population and Housing Impacts

Although most of the employment increases could be absorbed by the existing workforce, expanded job opportunities would induce modest

levels of in-migration to the area. It is likely that most of the in-migrating workers would have skills required for the construction and hospitality industries. A few workers would transfer to the area to fill RNSP positions created under alternative 4. The regional housing market would be modestly stimulated by increased housing demand of RNSP workers as well as by others employed in related activities. There would be no adverse population and housing impacts on the region.

Public and Commercial Services Impacts

Most municipal services, utilities, and other facilities in Humboldt and Del Norte Counties (including the cities of Eureka, Arcata, Trinidad, and Crescent City as well as the McKinleyville, Orick, and Klamath communities) would be unaffected by implementing alternative 4. The transportation infrastructure would not be significantly affected, although traffic on Eureka and Crescent City streets and U.S. Highways 101 and 199 would be expected to increase moderately. There would be no adverse impacts on municipal services or fiscal conditions of local governments in the two-county area. Utility infrastructure would not be adversely impacted. Onsite infrastructure within the parks, such as water, sewer, roads, and parking, would be enhanced substantially as part of the construction activities associated with the development of visitor facilities and improved road access. The costs for constructing utility infrastructure would be funded from special appropriations along with the other related facilities construction requirements.

Services provided by the private sector and used by visitors, such as grocery stores, restaurants, hotels/motels, RV campgrounds, banks, etc., would likely accrue financial benefits from increased RNSP-generated tourism. This might lead to increased private investment in facilities that serve tourists, particularly lodging, restaurants, and recreational services and retail shopping. The Yurok Tribe would benefit from

developing a lodge facility as part of its economic development strategy in cooperation with the parks.

Land Use Impacts

There could be changes in land use designation or zoning use classification due to RNSP land acquisition for resource protection. Indirect impacts would include moderate development of tourism-related infrastructure that could be accommodated under existing land use plans and zoning ordinances. Participation in gateway community planning through the provision of technical assistance by NPS and CDPR staff would be a beneficial impact.

Impacts on American Indian Tribes

There would be potentially substantial beneficial impacts on American Indian tribes under alternative 4. NPS and CDPR staff would work in partnership with the Yurok Tribe and other American Indian tribes in the area as well as other agencies and cultural preservation interest groups related to issues of mutual concern. Cooperation with these groups would primarily emphasize the development and presentation of educational and interpretive programs and other visitor use opportunities. Cooperative development of a destination resort would confer substantial economic benefits to the Yurok Tribe.

Conclusion

There would be substantial beneficial regional economic effects from increased spending on lodging, transportation, food, fuel, retail goods and services, etc. in the two-county impact area when compared to the no-action alternative. The economic benefits would be generated from both the construction and operation of new facilities and increased visitor use. There would be modest increases in population and small beneficial effects on housing. Similarly, there

would be no adverse impacts on public services and some modest beneficial impacts on land use planning due to the participation of the RNSP staff in gateway community planning. Finally, there would be no adverse impacts on American Indian tribes in the area under alternative 4.

Cumulative Impacts

Please see the discussion of cumulative impacts in the "Socioeconomic Impacts" chapter of alternative 1.



CONSULTATION AND COORDINATION

SCOPING

CDPR Notice of Preparation Filed

On December 16, 1997, the Department of Parks and Recreation, as the lead agency pursuant to Section 15082 (*California Code of Regulations*) of the *California Environmental Quality Act Guidelines*, prepared and circulated the required "Notice of Preparation."

Notice of Intent Filed in the *Federal Register*

The formal scoping process was initiated on May 24, 1996, when the National Park Service published in the *Federal Register* its intent to prepare an environmental impact statement/ environmental impact report on a general management/general plan for Redwood National and State Parks.

Public Scoping Open Houses

Initial public scoping open houses were held in June 1996 in Brookings, Oregon, and Crescent City, Klamath, Orick, and Eureka, California, to provide input on and identify major issues to be addressed in the environmental impact statement / environmental impact report. Public response from these open houses and from a mailback form in *Newsletter No. 1* were compiled, analyzed, and reported in *Newsletter No. 2*. About 120 people came to these open houses.

Newsletters

The following newsletters were sent to approximately 690 agencies, organizations, and individuals:

Newsletter No. 1 (May 1996). Contents: Planning Steps, Statements of Purpose for Redwood National & State Parks, Present

Concerns (issues), Announcing Public Open Houses.

Newsletter No. 2 (February 1997). Contents: The Planning Process Moves Ahead, Planning Steps, Scoping — What Should the Planning Team Be Looking at in the Management Plan, The Alternatives, Alternatives Draft Outline.

Consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service

Informal consultation with the U.S. Fish and Wildlife Service began in January 1997 with a request for a current list of endangered and threatened species that may be in the parks or may be affected by proposals in the plan. RNSP staff received the list in May 1997 and has received quarterly updates since that time. The most recent list was received in July 1999. The most notable changes to the list over this period are the addition of coastal cutthroat trout (candidate species), a change in the status of steelhead from proposed for listing as threatened to candidate species, and the deletion of four plant species. No changes in status of any of the currently listed species known to be present in the parks is anticipated before finalizing this plan. There may be changes in the status of proposed or candidate species.

With the listing of the coho salmon under the federal Endangered Species Act while the draft plan was in preparation, RNSP staff initiated informal consultation with the National Marine Fisheries Service for effects of RNSP projects on anadromous fish. NMFS staff will have the opportunity to review and comment on the draft plan. Formal consultation has been initiated on the watershed restoration program and for breaching operations at the Redwood Creek estuary, vegetation management, and the Davison Ranch (B-mill) trailhead project.

RNSP staff conduct informal consultations on a regular basis with US FWS staff for numerous RNSP/CDPR actions that have the potential to affect listed species or designated critical habitat. RNSP staff have initiated formal consultations for several maintenance and resource management programs, for an emergency action, and for one trail construction project. Under the programmatic consultations, RNSP staff prepare biological assessments that describe in detail the activity to be undertaken, with the location of the activity, equipment and personnel used, and how long the activity is expected to take, and a determination of the effects of each action on listed species and their habitat, including designated critical habitat. These assessments are submitted to the U.S. Fish and Wildlife Service, which reviews the assessment and issues a biological opinion. The biological opinion defines the conditions under which the RNSP staff is permitted to conduct the activity. The U.S. Fish and Wildlife Service uses the biological opinion to authorize incidental take of listed species that might occur as a result of the activity. RNSP staff report annually to the U.S. Fish and Wildlife Service on the amount of incidental take that actually occurred during the activity.

RNSP staff are conducting formal consultations with the U.S. Fish and Wildlife Service on the following programs and projects. Projects that could affect listed fish species are also subject to consultation with the National Marine Fisheries Service and are listed here for simplicity. Incidental take of northern spotted owls and marbled murrelets resulting from disturbance to nesting habitat that occurred as a result of these projects in 1998 totaled 1,273 acres of marbled murrelet nesting habitat and 843 acres of northern spotted owl nesting habitat.

Annual grading of Howland Hill road — No written biological assessment was on record for this activity. A biological opinion by the U.S. Fish and Wildlife Service was issued in June 1995 and amended in May 1998. A new biological assessment has been prepared to assess impacts for the next five years

(1999 to 2003). This assessment is currently undergoing review, and a new biological opinion is anticipated.

Annual maintenance of trails, roads and facilities — A biological assessment was completed in November 1997. A biological opinion by the U.S. Fish and Wildlife Service was issued in June 1998. A biological opinion by the National Marine Fisheries Service for effects on listed fish was issued in July 1998.

Those portions of the watershed restoration program that involve periodic maintenance and erosion control of roads eventually scheduled for removal, and for roads planned to be removed from 1998 to 2004. Separate biological assessments were completed for the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in May 1998. Biological opinions were issued by both these agencies in July 1998.

Construction of Skunk Cabbage Memorial Groves Trail — A biological assessment was completed in June 1998. A biological opinion by the U.S. Fish and Wildlife Service was issued in August 1998.

Davison Ranch Trailhead Project (B-Mill Deck) — RNSP staff completed consultation with the U.S. Fish and Wildlife Service in July 1999 and submitted a biological assessment to the National Marine Fisheries.

Vegetation management program — Biological assessments have been prepared on some vegetation management programs (conifer cutting for prairie restoration in the Bald Hills, exotic plant control, prescribed fire). These assessments were reviewed by the National Marine Fisheries and the U.S. Fish and Wildlife Service and are being revised.

Emergency rescue of heavy equipment — A front-end loader was driven off Howland Hill Road in April 1998 and was unable to return to the road without assistance. An emergency consultation was conducted and the equipment was rescued.

The U.S. Fish and Wildlife Service received a copy of the public draft of this plan and submitted comments. This final plan has been revised according to some of those comments, as described in the "Comment and Response" section. The final plan will be subject to consultation. Future consultations are anticipated for several programs and activities described in this general plan or for on-going programs on which RNSP staff has not yet consulted (conifer cutting for prairie restoration in the Bald Hills, fire management, exotic plant control, second-growth management, management and restoration of the Redwood Creek estuary, and trail planning and construction). Some project level consultation will be required on individual projects within larger program areas for actions that are necessary for ongoing management of RNSP resources or to allow visitor use in the parks.

Consultation with the California State Historic Preservation Officer and the Advisory Council on Historic Preservation

As stipulated by the October 1995 programmatic agreement among the National Conference of State Historic Preservation Officers, the Advisory Council on Historic Preservation, and the National Park Service, consultation with the California state historic preservation officer and the Advisory Council on Historic Preservation was initiated in May 1996 and will continue through the completion of the project. Both entities were invited to participate in the planning process, and each will have an opportunity to review and comment on the draft document.

Consultation with American Indians

Consultation with American Indians was initiated in May 1996, with the mailing of letters to the Big Lagoon Rancheria, Elk Valley Rancheria, Hupa Tribe, Resighini Rancheria, Smith River Rancheria, Tolowa Nation, Trinidad Rancheria, and Yurok Tribe of the Yurok

Reservation. The letters described the planning process, invited tribal representatives to be designated as consultants to the joint plan, and announced an American Indian scoping session in June 1996. About 25 individuals attended the scoping session, including officers, members, and staff of the Yurok Tribe, Tolowa Nation, and Hupa Tribe. The major issues raised at the scoping session included the following:

- Increased involvement of American Indians in the planning and implementation of actions that involve their ancestral lands.
- Management and protection of ethnographic sites throughout the parks should be undertaken in close coordination with the American Indian community.
- The lack of consistency of regulations between the National Park Service and the California Department of Parks and Recreation regarding the gathering of traditional materials by American Indians in the parks.

In June 1996 the National Park Service and the California Department of Parks and Recreation entered into a memorandum of understanding for government-to-government relations with the Yurok Tribe, to formalize "the process of communication for land and resources management decision making, education, planning and other government relations" at Redwood National and State Parks. As a result, the tribal heritage preservation officer of the Yurok Tribe is participating as an active consultant for the duration of the project.

Summary of Major Issues Raised During Scoping

This section includes a list of issues raised and addressed in this document. For issues raised but beyond the scope of this joint plan, see the discussion of issues beyond the scope of this joint plan in the "Introduction" section.

- type and degree of watershed restoration and management
- management of lands upstream of the parks
- Redwood Creek estuary restoration
- second-growth forest management
- restoration and management of historic prairies, oak woodlands, and forest openings
- fire management
- exotic plant management
- threatened and endangered wildlife
- management or removal of artificial impoundments
- cultural landscape identification and management
- maintenance and interpretation of historic structures
- preservation, management, interpretation, and use of archeological features and ethnographic sites
- appropriate visitor use levels in sensitive resources areas
- providing visitors with orientation and information
- interpretation of natural and cultural resources
- type, location, and management of recreational activities
- resource protection, visual quality, sanitation, safety, visitor services at Freshwater Lagoon Spit
- appropriate locations and use levels of vehicles on beaches
- road use and management
- need and location for a potential primary interpretive center and other smaller centers
- need, type, and location of administrative facilities
- need and appropriate location for a destination lodge
- protection of viewsheds and scenic quality
- coordinating management plans, visitor services, and marketing efforts with local interests to enhance the economic stability of local communities and achieve mutual objectives
- need for boundary adjustments and land acquisition
- need to study and identify areas in state parks that qualify for state wilderness designation

LIST OF AGENCIES AND ORGANIZATIONS WHO COMMENTED ON THE DRAFT MANAGEMENT PLAN

Public review of the draft plan involved distribution of 475 copies of the plan; production of 15,000 copies of a summary of the draft plan, distributed to the mailing list and as insert in the two local newspapers; and four public meetings and a number of focus group meetings and informal meetings conducted during the public review period, which was extended from 60 days to 90 days.

The final opportunity for formal public involvement will take place when the California Parks and Recreation Commission holds a public hearing on the plan in summer 1999.

About 600 comments (letters and preprinted signed forms) on the draft document were received. Many letters/forms have been printed, with agency responses, in volume 2. Many letters/forms focused on a single issue, and the agency responses printed in volume 2 speak to all the issues addressed even if a particular letter has not been reprinted.

Note: An * denotes that the National Park Service received a comment letter from this agency/organization/individual on the draft plan

Federal Agencies

Advisory Council on Historic Preservation*
Department of Agriculture, Forest Service
Six Rivers National Forest
Smith River National Recreation Area
Pacific Southwest Research Station*
Redwood Sciences Laboratory*
Department of the Army, U.S. Army Corps of Engineers *
Department of Commerce
National Marine Fisheries Service
Department of the Interior
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation

ENVIRONMENTAL CONSEQUENCES

U.S. Fish and Wildlife Service*
U.S. Geological Survey*
Department of Transportation
Federal Highway Administration
Federal Emergency Management Agency
U.S. Environmental Protection Agency*

American Indian Tribes

Big Lagoon Rancheria of California
Cher-Ae Heights Indian Community of the
Trinidad Rancheria, California
Coast Indian Community of Yurok Indians
of the Resighini Rancheria, California
Elk Valley Rancheria of California
Hoopa Valley Tribe of the Hoopa Valley
Reservation, California
Smith River Rancheria of California
Tolowa Nation
Tribal Heritage Preservation Officer of the
Yurok Tribe*
Yurok Tribe of the Yurok Reservation,
California*

State Agencies

California Coastal Commission
California Department of Conservation
California Department of Fish and Game*
California Department of Forestry and Fire
Protection*
California Department of Parks and
Recreation
California Department of Water Resources
California Division of Mines and Geology
California Department of Transportation*
California Office of Historic Preservation*
California Regional Water Quality Control
Board*
California State Clearinghouse
California State Lands Commission
California State Park and Recreation
Commission
California Water Resources Control Board

Local Agencies

City of Arcata
City of Crescent City*
City of Brookings
City of Eureka
Crescent City Harbor District
Curry County
County of Del Norte*
Gasquet Community Council
County of Humboldt*
Orick Community Services District*

Organizations

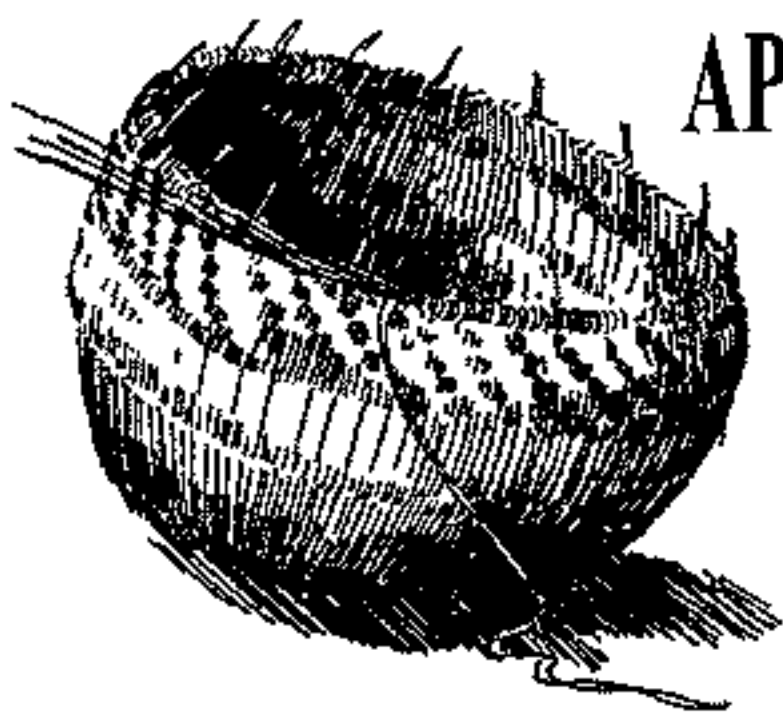
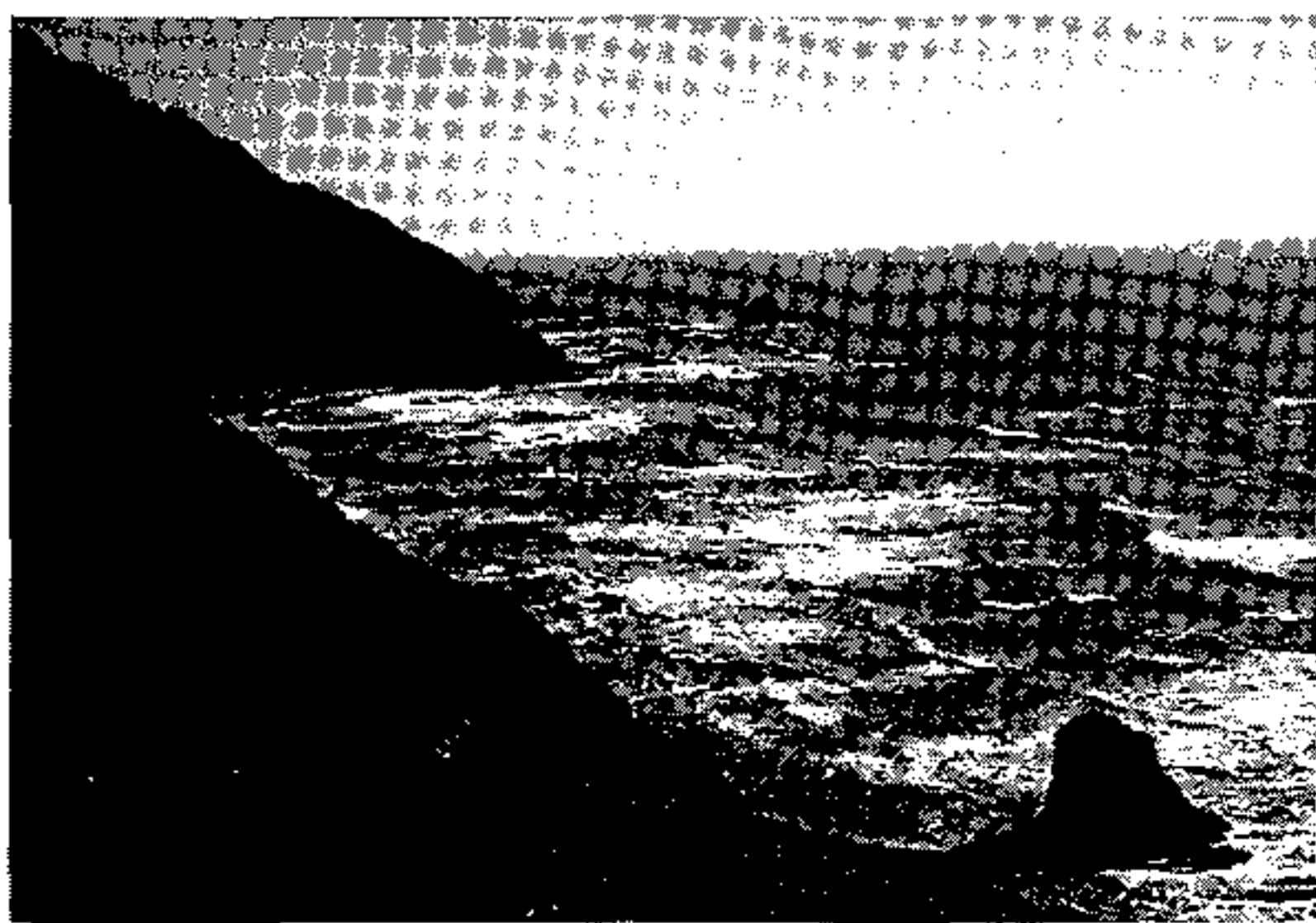
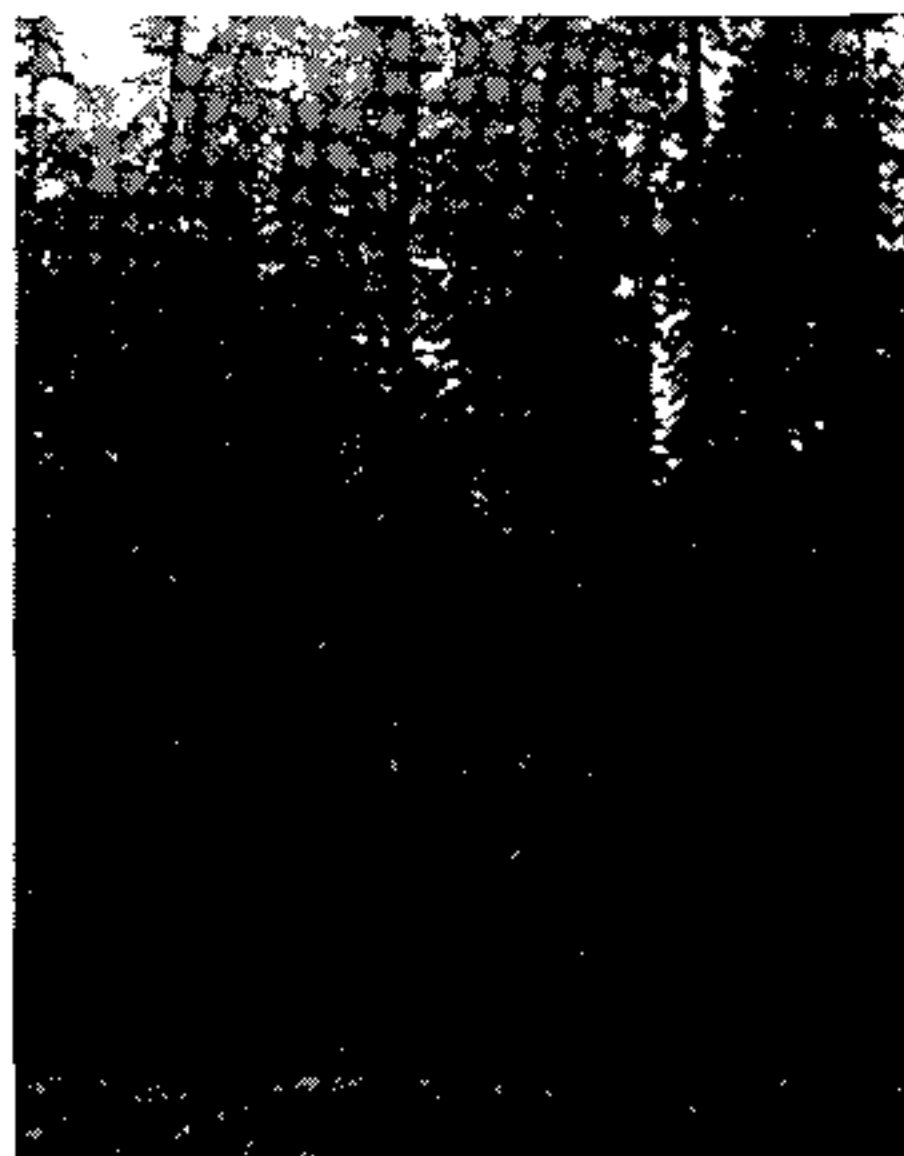
American Youth Hostels
Audubon Society
Arcata Chamber of Commerce*
Brookings Chamber of Commerce
California Commercial Beach Fishermen
Association*
California Fisheries
California Indian Basketweavers Association*
California Native Plants Society*
California Travel Parks Association*
California Trout
Chilula Native American Heritage Committee
Del Norte County Chamber of Commerce
Del Norte County Historical Society*
Del Norte Economic Development Corporation*
Fortuna Chamber of Commerce
Flight Feathers Wild Bird Rescue
and Transport*
Friends of California Parks
Friends of Del Norte County*
Good Sam Club
Greater Trinidad Chamber of Commerce*
Humboldt Coastal Coalition*
Humboldt County Historical Society
Indian Action Council
International Trailer and Travel Club
Klamath Chamber of Commerce*
League of Women Voters
McKinleyville Chamber of Commerce
National Coast Trail Association*

National Parks and Conservation Association
Pacific Regional Office*
Northern California Indian Development
Council
Nevada United Four Wheelers Association*
Northcoast Environmental Council*
North Coast Beach Fishermen
Northern California Recreation Association
Northwest Trail Riders
Orick Chamber of Commerce*
Orick Economic Development Corporation
Orick Tomorrow*
Pacific Coast Federation
Redwood Creek National Watershed Center*
Redwood Empire Association
Redwood Natural History Association*
Redwood Trails
Redwoods United
Requa Indian Community Association
Rio Dell-Scotia Chamber of Commerce*
Rogue Institute for Ecology
Save-the-Redwoods League*
Sempervirens Fund
Sierra Club, North Group, Redwood
Chapter*
Smith River Alliance*
Society of American Foresters
Straight Arrow Coalition
Trust for Public Lands
2020 Economic Development Committee of
the Del Norte County Chamber of
Commerce*

Weitchpec Indian Community Association
Wilderness Society
Women in Timber

Businesses

Benbow Valley RV Resort & Golf
Course*
Budget Automotive*
Chinook R.V. Resort*
Escapees RV Club*
Frank and Dean Solinsky
Company*
Giant Redwoods R.V. & Camp*
Good Harvest Cafe, Mark Lee*
Green Valley Market & Motel*
Holt Transportation Inc.*
Klamath Camper Corral*
Klamath River R.V. Park*
Orick Valley Guildhall,
Walter Popenuck*
Pacific Choice Seafoods Company*
Ramblin' Rose R.V. Park*
Snack Shack, Jackie and Cliff Pierce*
Trees of Mystery*
Village Camper Inn, Pamela Hintz*
Western Bus Nuts*



APPENDIXES, BIBLIOGRAPHY, GLOSSARY,
PREPARERS, AND INDEX

APPENDIX A: DEVELOPMENT COST ESTIMATES

Following are development cost estimates for the proposed action and alternatives as of June 1998. These cost estimates are rough NPS class C estimates based on the costs of similar facilities constructed by the Park Service in the Pacific west area through federal government contracts. Actual costs may be higher or lower depending on the final design, site conditions, and the contracting agency. Facilities may be constructed by the National Park Service, the California Department of Parks and Recreation, or some other entity such as a private or nonprofit corporation. Day labor projects using RNSP staff or volunteers would have lower costs than those shown below. Many assumptions on sizes and quantities had to be made to develop this cost estimate. These quantities will be refined during follow-up site-specific planning and design efforts and may be different than those used for this estimate.

Project planning includes surveys, more detailed site planning, facility design, construction documents, and additional project compliance activities (25% of net). Facility costs were developed using the NPS Denver Service Center cost estimating database.

These estimates are intended primarily to assist in comparing the relative costs of the alternatives in the environmental impact statement and are not intended for use in developing budget requests without some additional planning or design work. Some figures also may not add up due to rounding.

Funding for many elements of the plan, including most items in this appendix, is subject to the limited in-park capabilities, agency priorities on a national and statewide basis, uncertainties in the legislative appropriation process, and unknowns related to donated funds.

APPENDIXES

TABLE A-1: ALTERNATIVE 1, PROPOSED ACTION DEVELOPMENT COSTS, JUNE 1998

Item	Gross Construction Cost	Construction Planning	Total Cost
Public Use, Recreation, and Visitor Safety			
Tall Trees Redesign parking area (20 cars)	\$27,000	\$5,000	\$32,000
Fern Canyon Relocate parking area 25-car parking area (gravel) 50' access road (gravel) gate vault toilet (large) site restoration (.5 acre)	\$34,000 7,000 3,000 68,000 29,000	\$6,000 1,000 1,000 13,000 6,000	\$40,000 8,000 4,000 81,000 35,000
Crescent Beach Relocate parking area 25-car parking area (paved) 100' access road (paved) gate vault toilet (large) site restoration (.5 acre)	\$83,000 25,000 3,000 68,000 29,000	\$16,000 5,000 1,000 13,000 6,000	\$99,000 30,000 4,000 81,000 35,000
Bald Hills Add 5 waysides 15-car parking area (total) (paved) 5 wayside exhibits 200' access roads (paved)	\$50,000 23,000 50,000	\$9,000 4,000 10,000	\$59,000 27,000 60,000
Subtotal	\$499,000	\$96,000	\$595,000
RECREATIONAL ACTIVITIES			
Camping Provide additional campsites in campgrounds: 75 new sites (complete with comfort stations, roads, parking, and utilities)	\$737,000	\$141,000	\$878,000
Picnic Sites at Bald Hills 30 picnic sites (total) 30 parking spaces (in 5 areas) (paved) 200' access roads (paved) 5 vault toilets (standard)	\$197,000 99,000 50,000 151,000	\$38,000 19,000 10,000 29,000	\$235,000 118,000 60,000 180,000
Subtotal	\$1,234,000	\$237,000	\$1,471,000
ACCESS AND CIRCULATION			
Jedediah Smith Redwoods State Park Entrance 600' paved access road 8-car parking area (paved) entrance kiosk (100 sf) utilities connection (200')	\$149,000 27,000 11,000 11,000	\$29,000 5,000 2,000 2,000	\$178,000 32,000 13,000 13,000
Stout Grove Resurface parking area (15 cars) Minor road upgrades (500')	\$15,000 39,000	\$3,000 8,000	\$18,000 47,000
Del Norte Coast Redwoods State Park Entrance Construct new 2-mile paved access road 8-car parking area (paved) entrance kiosk (100 sf) connect utilities (200') Obliterate existing road (1 mile)	\$2,620,000 27,000 11,000 11,000 255,000	\$500,000 5,000 2,000 2,000 49,000	\$3,120,000 32,000 13,000 13,000 304,000
Alder Camp Road Minor upgrade of 2.2 miles	\$778,000	\$148,000	\$926,000
Davison Road Minor upgrade (includes surface improvements, straightening some curves, widening short sections, installing turnouts), 3 miles (gravel)	\$1,061,000	\$203,000	\$1,264,000

Appendix A: Development Cost Estimates

Item	Gross Construction Cost	Construction Planning	Total Cost
Cal-Barrel Road Minor upgrade, 2.5 miles (gravel)	\$884,000	\$169,000	\$1,053,000
Howland Hill Road Minor upgrade, 4 miles (gravel)	\$1,415,000	\$270,000	\$1,685,000
Subtotal	<u>\$7,314,000</u>	<u>\$1,397,000</u>	<u>\$8,711,000</u>
FACILITIES			
Primary Visitor Center Construct center (4,000 sf) interpretive media (1,000 sf) 60-car parking area (paved) access road (100') (paved) water connection (100') septic system landscape development (25% of net bldg cost)	\$1,362,000 328,000 199,000 25,000 4,000 66,000 341,000	\$260,000 63,000 38,000 5,000 1,000 13,000 65,000	\$1,622,000 391,000 237,000 30,000 5,000 79,000 406,000
Hiouchi Information Center Construct center (2000 sf) interpretive media (400 sf) 30-car parking area (paved) access road (300') (paved) water connection (300') septic system landscape development (25% of net building cost)	\$681,000 131,000 99,000 75,000 12,000 39,000 170,000	\$130,000 25,000 19,000 14,000 2,000 8,000 33,000	\$811,000 156,000 118,000 89,000 14,000 47,000 203,000
Operational Facilities Aubell: Construct shop/office (900 sf) Expand vehicle/equipment storage yard (1,000 sf) Requa Maintenance Facilities:* Upgrade utility systems (water, sewer, & electric) Stabilize existing structures Construct support facilities (parking, storage, etc.)	\$177,000 20,000 1,572,000 1,179,000 328,000	\$34,000 4,000 300,000 225,000 62,000	\$211,000 24,000 1,872,000 1,404,000 390,000
Subtotal	\$6,808,000	\$1,301,000	\$8,109,000
ALTERNATIVE 1 GRAND TOTAL	\$15,855,000	\$3,031,000	\$18,886,000

* These figures do not include costs for new facilities if the current facilities are threatened by landslides and earthflow.

APPENDIXES

TABLE A-2: ALTERNATIVE 2, NO ACTION, DEVELOPMENT COSTS, JUNE 1998

Item	Gross Construction Cost	Construction Planning	Total Cost
RECREATIONAL ACTIVITIES			
Camping			
Build four new campgrounds: 400 campsites total (complete with comfort stations, roads, parking, and utilities)	\$6,878,000	\$1,313,000	\$8,191,000
Provide additional campsites in existing campgrounds: 60 new sites total (complete)	590,000	113,000	703,000
Subtotal	\$7,468,000	\$1,426,000	\$8,894,000
Facilities			
Operational Facilities			
Aubell:			
Construct shop/office (900 sf)	\$177,000	\$34,000	\$211,000
Expand vehicle/equipment storage yard (1,000 sf)	20,000	4,000	24,000
Requa Maintenance Facilities:*			
Upgrade utility systems (water, sewer, & electric)	1,572,000	300,000	1,872,000
Stabilize existing structures	1,179,000	225,000	1,404,000
Construct support facilities (parking, storage, etc.)	328,000	62,000	390,000
Subtotal	\$3,276,000	\$625,000	\$3,901,000
ALTERNATIVE 2 GRAND TOTAL	\$10,744,000	\$2,051,000	\$12,795,000

* These figures do not include costs for new facilities if the current facilities are threatened by landslides and earthflow.

TABLE A-3: ALTERNATIVE 3 DEVELOPMENT COSTS, JUNE 1998

Item	Gross Construction Cost	Construction Planning	Total Cost
PUBLIC USE, RECREATION, AND VISITOR SAFETY			
Fern Canyon			
Relocate parking area			
25 parking spaces (gravel)	\$34,000	\$6,000	\$40,000
50' access road (gravel)	7,000	1,000	8,000
gate	3,000	1,000	4,000
vault toilet (large)	68,000	13,000	81,000
site restoration (.5 acre)	29,000	6,000	35,000
Crescent Beach			
Relocate parking area: site restoration (.5 acre)	59,000	11,000	70,000
Subtotal	\$200,000	\$38,000	\$238,000
ACCESS AND CIRCULATION			
Newton P. Drury Scenic Parkway			
Relocate road through Elk Prairie: 1.5 mi. (paved)	\$2,358,000	\$450,000	\$2,808,000
Jedediah Smith Redwoods State Park Entrance			
Make access improvements to existing entrance (500 sy)	\$33,000	\$6,000	\$39,000
Widen entrance road (50 sy)	5,000	1,000	6,000
Construct new entrance station (100 sf)	15,000	3,000	18,000
Enlarge parking area by 5 cars	17,000	3,000	20,000
Subtotal	\$2,428,000	\$463,000	\$2,891,000
FACILITIES			
Primary Visitor Center			
Construct center (4000 sf)	\$1,362,000	\$260,000	\$1,622,000
interpretive media (1,000 sf)	328,000	63,000	391,000
60-car parking area (paved)	199,000	38,000	237,000
access road (300' paved)	75,000	14,000	89,000
water connection (300')	12,000	2,000	14,000
septic system	66,000	13,000	79,000
landscape development (25% of net building cost)	341,000	65,000	406,000
Operational Facilities			
Aubell:			
Construct shop/office (900 sf)	\$177,000	\$34,000	\$211,000
Expand vehicle/equipment storage yard (1000 sf)	20,000	4,000	24,000
Requa Maintenance Facilities:*			
Upgrade utility systems (water, sewer, & electric)	1,572,000	300,000	1,872,000
Stabilize existing structures	1,179,000	225,000	1,404,000
Construct support facilities (parking, storage, etc.)	328,000	62,000	390,000
Subtotal	\$5,659,000	\$1,080,000	\$6,739,000
ALTERNATIVE 3 GRAND TOTAL	\$8,287,000	\$1,581,000	\$9,868,000

* These figures do not include costs for new facilities if the current facilities are threatened by landslides and earthflow.

TABLE A-4. ALTERNATIVE 4 DEVELOPMENT COSTS, JUNE 1998

Item	Gross Construction Cost	Construction Planning	Total Cost
PUBLIC USE, RECREATION, AND VISITOR SAFETY			
Fern Canyon			
Expand and pave parking area:			
35 parking spaces (paved)	\$116,000	\$22,000	\$138,000
50' access road	12,000	2,000	14,000
vault toilet (large)	68,000	13,000	81,000
Crescent Beach			
Relocate and enlarge parking area:			
35 parking spaces (paved)	\$116,000	\$22,000	\$138,000
100' access road	25,000	5,000	30,000
gate	3,000	1,000	4,000
vault toilet (large)	68,000	13,000	81,000
Enlarge picnic area (25 sites)	164,000	31,000	195,000
Bald Hills			
Add 5 waysides:			
15 parking spaces (three ea. in 5 areas - gravel)	\$20,000	\$4,000	\$24,000
5 wayside exhibits	23,000	4,000	27,000
200' access roads (gravel)	28,000	5,000	33,000
Subtotal	\$643,000	\$122,000	\$765,000
RECREATIONAL ACTIVITIES			
Camping			
Provide additional campsites in campgrounds: 150 new sites (complete)	\$1,474,000	\$282,000	\$1,756,000
Freshwater Lagoon Spit			
Develop campground, 30 sites (complete)	\$472,000	\$90,000	\$562,000
Connect to water (1000')	38,000	7,000	45,000
Install septic system	66,000	13,000	79,000
Picnic Sites at Bald Hills			
30 picnic sites (total)	\$197,000	\$38,000	\$235,000
30 parking spaces (in 5 areas)	41,000	8,000	49,000
200' access roads (gravel)	28,000	5,000	33,000
5 vault toilets (standard)	151,000	29,000	180,000
Subtotal	\$2,467,000	\$472,000	\$2,939,000
ACCESS AND CIRCULATION			
Davison Road to Fern Canyon			
Widen and pave 8 miles of gravel road	\$8,384,000	\$1,600,000	\$9,984,000
Jedediah Smith Redwoods State Park Entrance			
600' paved access road	\$149,000	\$29,000	\$178,000
8-car parking area	27,000	5,000	32,000
entrance kiosk (100 sf)	11,000	2,000	13,000
connect utilities (200')	11,000	2,000	13,000
Stout Grove			
Expand and pave parking area, 25 cars	66,000	13,000	79,000
Del Norte Coast Redwoods State Park Entrance			
Construct new 2-mile paved access road	\$2,620,000	\$500,000	\$3,120,000
8-car parking area	27,000	5,000	32,000
entrance kiosk (100 sf)	11,000	2,000	13,000
utilities connection (200')	11,000	2,000	13,000
Obliterate existing road (1 mile)	255,000	49,000	304,000
Alder Camp Road			
Minor upgrade of 2.2 miles	778,000	148,000	926,000
Cal-Barrel Road			
Widen and pave 2.5 miles of gravel road	\$2,620,000	\$500,000	\$3,120,000

Appendix A: Development Cost Estimates

Item	Gross Construction Cost	Construction Planning	Total Cost
Howland Hill Road Pave 8-mile road	\$8,384,000	\$1,600,000	\$9,984,000
Tall Trees Grove Widen and pave 5.5 miles of access road Expand and pave parking area, 40 cars	\$5,764,000 105,000	\$1,100,000 20,000	\$6,864,000 125,000
Coastal Drive Realign and widen 4.5 mile section of road (gravel)	\$1,572,000	\$300,000	\$1,872,000
Subtotal	\$30,795,000	\$5,877,000	\$36,672,000
FACILITIES			
Hiouchi Information Center Construct center (2,000 sf) interpretive media (400 sf) 30-car parking area access road (300') water connect (300') septic system landscape development (25% of net building cost)	\$681,000 131,000 99,000 75,000 12,000 39,000 170,000	\$130,000 25,000 19,000 14,000 2,000 8,000 33,000	\$811,000 156,000 118,000 89,000 14,000 47,000 203,000
Mill Creek Visitor Center Construct center (700 sf) interpretive media (100 sf) 8-car parking area access road (50') water connection (50') septic system landscape development (25% of net building cost)	\$238,000 33,000 27,000 12,000 2,000 26,000 60,000	\$46,000 6,000 5,000 2,000 1,000 5,000 12,000	\$284,000 39,000 32,000 14,000 3,000 31,000 72,000
Operational Facilities Aubell: Construct shop/office (900 sf) Expand vehicle/equipment storage yard (1000 sf) Requa Maintenance Facilities:* Upgrade utility systems (water, sewer, & electric) Stabilize existing structures Construct support facilities (parking, storage, etc.)	\$177,000 20,000 1,572,000 1,179,000 328,000	\$34,000 4,000 300,000 225,000 62,000	\$211,000 24,000 1,872,000 1,404,000 390,000
Subtotal	\$4,881,000	\$933,000	\$5,814,000
ALTERNATIVE 4 GRAND TOTAL	\$38,786,000	\$7,404,000	\$46,190,000

* These figures do not include costs for new facilities if the current facilities are threatened by landslides and earthflow.

APPENDIX B: RNSP OPERATIONS AND MAINTENANCE COSTS

TABLE B-1: ALTERNATIVE 1, PROPOSED ACTION, STAFFING COSTS

Function	Number	Appointment	Estimated Cost
Park Management	4	Full-time	\$ 260,000
Administration	16	Full-time	603,000
Administration	2	Temporary	32,000
Interpretation	13	Full-time	543,300
Interpretation	31	Seasonal	300,800
Resource Protection and Visitor Services	16	Full-time	932,400
Resource Protection and Visitor Services	25	Seasonal	228,000
Natural & Cultural Resource Management	45	Full-time	1,427,200
Natural & Cultural Resource Management	17	Seasonal	180,100
Maintenance	33	Full-time	1,486,600
Maintenance	53	Seasonal	461,200
Planner/Landscape Architecture	1	Full-time	55,100
TOTAL			\$ 6,509,700

TABLE B-2: ALTERNATIVE 1, PROPOSED ACTION, OPERATIONS AND MAINTENANCE COSTS

Facility/Operation	Estimated Total Cost Per Year
Travel/training	\$ 75,000
Vehicles	276,300
Utilities	282,000
Contracting Services	1,472,000
Supplies: Materials	105,000
Capitalized Equipment	56,000
Cyclic Maintenance & Equipment Replacement Program	681,000
Interpretive Media Equipment	60,000
Total	\$ 3,007,300
GRAND TOTAL	\$ 9,517,000

TABLE B-3: ALTERNATIVE 2, NO ACTION, STAFFING COSTS

Function	Number	Appointment	Estimated Cost
Park Management	4	Full-time	\$ 260,000
Administration	16	Full-time	603,000
Administration	2	Temporary	32,000
Interpretation	7	Full-time	332,000
Interpretation	22	Seasonal	210,000
Resource Protection and Visitor Services	18	Full-time	1,071,000
Resource Protection and Visitor Services	37	Seasonal	345,000
Natural and Cultural Resource Management	43	Full-time	1,317,000
Natural and Cultural Resource Management	10	Seasonal	90,000
Maintenance	37	Full-time	1,753,000
Maintenance	58	Seasonal	512,000
TOTAL			\$ 6,525,000

TABLE B-4: ALTERNATIVE 2, NO ACTION, OPERATIONS AND MAINTENANCE COSTS

Facility/Operation	Estimated Total Cost Per Year
Travel/training	\$ 81,000
Vehicles	306,300
Utilities	227,000
Contracting Services	455,000
Supplies: Materials	120,000
Capitalized Equipment	51,000
Cyclic Maintenance & Equipment Replacement Program	650,000
TOTAL	\$ 1,890,300
GRAND TOTAL	\$ 8,415,300

TABLE B-5: ALTERNATIVE 3, STAFFING COSTS

Function	Number	Appointment	Estimated Cost
Park Management	4	Full-time	\$ 260,000
Administration	16	Full-time	603,000
Administration	2	Temporary	32,000
Interpretation	8	Full-time	377,500
Interpretation	29	Seasonal	278,800
Resource Protection and Visitor Services	17	Full-time	963,100
Resource Protection and Visitor Services	25	Seasonal	228,000
Natural and Cultural Resource Management	45	Full-time	1,427,200
Natural and Cultural Resource Management	17	Seasonal/Career Seasonal	180,100
Maintenance	32	Full-time	1,460,500
Maintenance	51	Seasonal	432,900
Planner/Landscape Architect	1	Full-time	55,100
TOTAL			\$ 6,298,200

TABLE B-6: ALTERNATIVE 3, OPERATIONS AND MAINTENANCE COSTS

Facility/Operation	Estimated Total Cost Per Year
Travel/training	\$ 71,000
Vehicles	276,300
Utilities	282,000
Contracting Services	1,432,000
Supplies: Materials	140,000
Capitalized Equipment	50,000
Cyclic Maintenance & Equipment Replacement Program	621,000
Interpretive Media Equipment	25,000
Total	\$ 2,907,300
GRAND TOTAL	\$ 9,205,500

TABLE B-7: ALTERNATIVE 4, STAFFING COSTS

Function	Number	Appointment	Estimated Cost
Park Management	4	Full-time	\$ 260,000
Administration	16	Full-time	603,000
Administration	2	Temporary	32,000
Interpretation	13	Full-time	543,300
Interpretation	37	Seasonal	366,800
Resource Protection and Visitor Services	16	Full-time	932,400
Resource Protection and Visitor Services	27	Seasonal	250,000
Natural and Cultural Resource Management	45	Full-time	1,427,200
Natural and Cultural Resource Management	17	Seasonal	180,100
Maintenance	35	Full-time	1,556,700
Maintenance	59	Seasonal	499,300
Planner/Landscape Architect	1	Full-time	55,100
TOTAL			\$ 6,705,900

TABLE B-8: ALTERNATIVE 4, OPERATIONS AND MAINTENANCE COSTS

Facility/Operation	Estimated Total Cost Per Year
Travel/training	\$ 85,000
Vehicles	276,300
Utilities	264,000
Contracting Services	652,000
Supplies: Materials	100,000
Capitalized Equipment	69,000
Cyclic Maintenance & Equipment Replacement Program	731,000
Interpretive Media Equipment	80,000
TOTAL	\$ 2,255,300
GRAND TOTAL	\$ 8,961,200

APPENDIX C: NPS AND CDPR MEMORANDUM OF UNDERSTANDING



United States Department of the Interior
California Department of Parks and Recreation
Redwood National and State Parks



Agreement No. CA8480-4-9003

MEMORANDUM OF UNDERSTANDING
between
NATIONAL PARK SERVICE
and
CALIFORNIA DEPARTMENT OF PARKS AND RECREATION

for

THE COOPERATIVE MANAGEMENT OF
THE REDWOOD NATIONAL AND STATE PARKS

THIS MEMORANDUM OF UNDERSTANDING is made and entered into this 13th day of April, 1994, by and between the STATE OF CALIFORNIA, acting through the California Department of Parks and Recreation, hereinafter called "CDPR", and the UNITED STATES OF AMERICA, acting through the National Park Service, hereinafter called "NPS".

Article I. Background and Authority

WHEREAS, The Report of the California Coordinating Committee on Operational Efficiencies, representing the combined recommendations of the CDPR and the NPS, concludes that Jedediah Smith Redwoods State Park, Del Norte Coast Redwoods State Park, Prairie Creek Redwoods State Park and Redwood National Park, all located within the congressionally authorized boundary of the national park, should be cooperatively managed by both agencies under a Memorandum of

Understanding and collectively referred to as "Redwood National and State Parks"; and

WHEREAS, The Committee concludes such cooperative management would allow the identification, development and implementation of operational efficiencies resulting in enhanced protection of park resources and improved service to the public; and

WHEREAS, pursuant to the provisions of Section 5080.30 of the Public Resources Code of the State of California, CDPR may enter into agreements with agencies of the United States for the care, maintenance, administration and control of lands under the jurisdiction of CDPR by any party of the agreement for the purposes of the State Park System; and

WHEREAS, NPS may contract for the use and management of CDPR lands pursuant to "an Act to establish a Redwood National Park..." approved October 2, 1968 (P.L. 90-545: 82 Stat. 931, 16 USC 79a, 79c), as amended by the Act of March 27, 1978 (P.L. 95-250: 92 Stat. 163); and

WHEREAS, NPS is authorized to aid in planning and cooperating with CDPR for the purpose of developing coordinated and adequate public park facilities, pursuant to the Act of June 23, 1936 (ch. 735, sec. 2: 49 Stat. 1894), and

APPENDIXES

WHEREAS, NPS has acquired for park and recreational purposes certain real property generally referred to and known as Redwood National Park; and

WHEREAS, CDPR and NPS desire to enter into an agreement to provide for cooperative management of all CDPR and NPS lands within the congressionally authorized boundaries of Redwood National Park;

NOW THEREFORE, in consideration of the foregoing, the parties hereto do hereby covenant and agree as follows:

Article II. Statement of Objectives

1. NPS and CDPR do mutually adopt the designation "Redwood National and State Parks", hereinafter referred to as PARKS, for use by both agencies in referring to the area within the congressionally authorized boundary of Redwood National Park.
2. To the extent practicable, NPS and CDPR mutually agree to commit the respective resources, staff, equipment and facilities assigned to the PARKS to the common protection of all resources contained within the PARKS, as well as for the appropriate enjoyment and appreciation of the same by the public, without regard to governmental ownership.

3. CDPR shall identify and staff a position to serve as a liaison with Redwood National Park and the three aforementioned State Park units on a day-to-day basis. This person will be duty-stationed at the Redwood National Park Headquarters in Crescent City, with responsibility over the three state parks and decision-making powers on their behalf. NPS will provide office space and support for the CDPR liaison. A CDPR resources management liaison will be established to work cooperatively with Redwood National Park in implementing and coordinating resource management projects.

4. NPS and CDPR shall seek to attain cooperative operating procedures and practices that result in efficiencies and cost savings accruing to both partners. Budget records of expenses and revenues shall be maintained for each agency's PARKS operation and it is the parties intent that all savings accruing therefrom shall be utilized for the enhanced protection of PARKS resources and service to the PARKS visitors.

5. Operating procedures and standards for the PARKS shall be developed by NPS and CDPR, to ensure joint accomplishments of PARKS activities, including but not limited to: visitor protection and public safety, public information, interpretation and publications, resource management, maintenance, design and construction, planning, signing, and the development of policies. To the extent practicable and maintaining agency identity, work performed in the PARKS will be conducted by personnel without respect to agency affiliation. Through signing, publications and other instruments of communication with the public, the

APPENDIXES

cooperative management of the PARKS by CDPR and NPS should be projected to visitors, park neighbors and governmental agencies.

6. Both NPS and CDPR shall work with the PARKS to provide flexibility and latitude in policy and direction to promote cooperative operations and efficiencies in the best interests of the PARKS.

7. PARKS staff shall cooperatively prepare an annual workplan that identifies common projects resulting in interagency cost efficiencies. The workplan will contain specific goals, actions and target completion dates, to be incorporated in the performance standards of the responsible NPS and CDPR PARKS Superintendents. The workplan will be an annual amendment to this agreement.

8. To the extent practicable PARKS planning will be cooperatively produced, reviewed and approved. Ongoing planning efforts will be modified to accommodate the participation of both CDPR and NPS. Existing plans will serve as current direction, pending their revision or replacement. The agencies shall speak with one voice in the review of non-PARKS plans that affect PARKS interests. NPS and CDPR shall work toward the development of a new General Management Plan for the PARKS, to provide a blueprint for the future of the coordinated PARKS operations. NPS will seek funds and assistance for the development of this Plan.

Article III. Term of Agreement

This Memorandum of Understanding hereby made shall terminate five (5) years from the effective date hereof, unless prior thereto it is relinquished, abandoned, or otherwise terminated pursuant to the provision of this agreement or of any applicable Federal or State law or regulation. This agreement may be renewed or otherwise amended by the mutual written agreement of the parties. The effective date of this agreement shall be the date when appropriate signatures are obtained.

Article IV. Key Officials

Superintendent
Redwood National Park
1111 Second Street
Crescent City, California 95531

Superintendent
North Coast Redwoods District
600-A West Clark Street
Eureka, California 95501

Regional Director
National Park Service
Western Regional Office
600 Harrison Street
San Francisco, California 94107-1372

Director
Department of Parks and Recreation
State of California
1416 9th Street
Sacramento, California 94926-0001

Article V. Expenses

Nothing in this agreement shall be construed as obligating NPS or CDPR to expend any funds in excess of appropriations authorized by law. The commitment of funds in furtherance of this Memorandum of Understanding shall be authorized by individual amendments. When the work to be accomplished and the work program are mutually agreed upon by both parties, an appropriate agreement with specifying its authority, shall be consummated obligating funds where necessary.

APPENDIXES

Article VI. Reports

A cooperative one-year workplan for the PARKS will be submitted for final approval to the NPS Regional Director and the CDPR Director no later than 120 days from the signing of this agreement and annually thereafter.

As specified in the CDPR-NPS headquarters MOU signed by the NPS Regional Director and CDPR Director, a status report on progress and accomplishment by the PARKS will be submitted to both Directors on a six-month basis.

At the end of the first three years from the approval date of the CDPR-NPS headquarters interagency MOU, the PARKS will provide requested input to the analysis of the overall success of this cooperative effort and modification needed to improve the effort.

Article VII. Property Utilization and Disposition

Any tools, equipment, material or other property supplied by NPS shall remain the property of the NPS. Similarly, any tools, equipment, material or other property supplied by CDPR shall remain the property of the State of California.

Article VIII. Termination

Either party may terminate this Memorandum of Understanding earlier by providing sixty (60) days written notice to the other, following an analysis and review by the NPS Regional Director and the CDPR Director of the rationales for seeking termination.

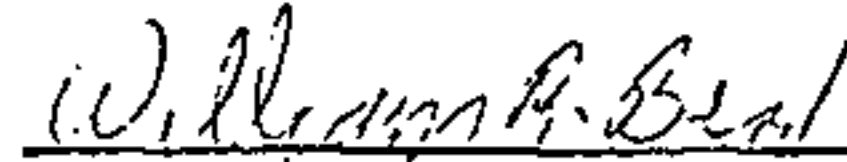
Article IX. Required Clauses

1. During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on nondiscrimination and will not discriminate against any person because of race, color, religion, sex or national origin. The participants will take affirmative action to ensure that applicants are employed without regard to their race, color, religion, sex or national origin.

2. No member or delegate to Congress or resident commissioner shall be admitted to any share or part of this agreement or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Signature blocks:


 Date 4-17-94
Superintendent
Redwood National Park

 Date 4-19-94
Superintendent
North Coast Redwoods District

MOU WITH CDPR AND NPS


Agreement No. CA8480-4-9003
Page 9

I concur.


Regional Director
Western Region
National Park Service

5/2/94
Date

I concur.


Director
California Department of Parks
and Recreation

5/16/94
Date

**APPENDIX D: MEMORANDUM OF UNDERSTANDING AMONG
NATIONAL PARK SERVICE, REDWOOD NATIONAL PARK;
CALIFORNIA DEPARTMENT OF PARKS AND RECREATION,
PRAIRIE CREEK REDWOODS STATE PARK
AND
THE YUOK TRIBE
FOR GOVERNMENT TO GOVERNMENT RELATIONS**

ARTICLE I. OBJECTIVES

Whereas, the Yurok Tribe ("Tribe") and the National Park Service, Redwood National Park and California Department of Parks and Recreation, Prairie Creek Redwoods State Park ("Parks") wish to establish and formalize a Government-to-Government relationship; and

Whereas, the Tribe and the Parks recognize the benefits of formalizing the process of communication for land and resources management decision making, education, planning and other governmental relations; and

Whereas, the Tribe and the Parks recognize that a strong working relationship is the best course in achieving our common goals of education and the preservation and management of natural and cultural resources.

ARTICLE II. BACKGROUND

Whereas, the Yurok have lived on lands now within the Parks for thousands of years and were the keepers of these lands now managed by the Parks; and

Whereas, The Tribe is a Federally-Recognized Indian Tribe, included in the Federal Register (October 21, 1993) listing of Indian Tribal Entities Within the Contiguous 48 States Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs; and

Whereas, the Yurok Tribal Council is the formally constituted governing body of the Tribe, entrusted with the responsibility to protect, preserve and promote the utilization of the ceremonial, subsistence and economic resources and interests of the Yurok people; and

Whereas, the Yurok Tribe is a participant in the Self-Governance Program administered by the Office of Self-Governance of the Bureau of Indian Affairs; and

Whereas, the Tribe has applied for, and has received initial approval for, the delegation of State Historic Preservation Officer functions on tribal (reservation) lands, and whereas a portion of Redwood National Park lands are within the boundaries of the Yurok Reservation; and

Whereas, the general membership of the Tribe approved the Constitution of the Yurok Tribe, wherein Article IV, Sections 1 and 5 define the authority of the Tribal Council and confirm the Council's ability to enter into this Agreement with the Parks; and

Whereas, the Parks have responsibility for management of Redwood National Park and Prairie Creek Redwoods State Park lands that are the ancestral lands of the Tribe; and

Whereas, the National Park Service (NPS) Management Policies (1988) prescribe that the NPS will develop and execute its programs in a manner that reflects knowledge of and respect for the cultures, traditions and religious beliefs of Native Americans with ancestral ties to park lands; and

Whereas, the NPS is directed by the Presidential Memorandum of April 29, 1994 (Federal Register May 4, 1994) to operate within a government-to-government relationship with federally recognized tribal governments; and

Whereas, the California Department of Parks and Recreation is authorized to participate in this Memorandum of Understanding (MOU) through Section 5080.30 of the Public Resources Code of the State of California; and

NOW THEREFORE BE IT RESOLVED, the Tribe and the Parks agree to establish Government-to-Government relationships as follows:

ARTICLE III. STATEMENT OF WORK

1. The Parks and the Tribe shall meet quarterly. These meetings are for the purpose of providing update and review of up-coming or on-going projects and to monitor the effectiveness of this Agreement. At these meetings, the Parks shall be represented by the Redwood National Park Superintendent, and/or his/her designee(s); the California Department of Parks and Recreation Superintendent, and/or his/her designee(s); and the Redwood National Park Native American Liaison; the Tribe shall be represented by the Tribal Council and/or their designee(s).

2. The Parks shall consult, to the greatest extent practicable and to the extent permitted by law, with the Tribe prior to taking actions that affect federally recognized tribal governments and trust resources. All such consultations are to be open and candid so that all interested parties may evaluate for themselves the potential impact of relevant proposals.

Subjects to be covered in such consultations shall include at a minimum: park planning documents, natural and cultural resources management projects and proposed developments.

3. The Parks and the Tribe, a self-governance/compacting tribe, will work towards implementation of the Tribal Self-Governance Act of 1994.

4. The Parks and the Tribe will pursue opportunities to work cooperatively on economic development projects which will be to the benefit of both the Parks and the Tribe.

5. The Parks and the Tribe will place special emphasis on working together on cultural issues including but not limited to: protection of Yurok cultural sites, exchange of information regarding Yurok culture and Yurok cultural sites, the Parks' interpretive programs of Yurok culture, and the disposition of artifacts from Yurok aboriginal territory in the Parks' collections.

6. The Parks, to the extent allowed by law and applicable regulations and consistent with the responsible stewardship of the Parks resources, will provide for the collecting of natural resources for traditional Yurok activities.

7. The Parks and the Tribe will share relevant non-proprietary information pertaining to the inventory and management of the Parks lands. Research, transfer of technology and technical assistance are important components of this Government-to-Government relationship.

8. The Parks will work towards the recruitment and employment of Tribal members.

ARTICLE IV. ADDITIONAL AGREEMENTS

1. This Memorandum of Understanding is among the National Park Service, Redwood National Park; California Department of Parks and Recreation, Prairie Creek Redwoods State Park; and the Yurok Tribe. The parties involved in this MOU do not represent any other units of the National Park System, California Department of Parks and Recreation units or Indian Tribes.

2. Nothing in this MOU shall abrogate the statutory or regulatory authority or responsibility of any of the parties.

ARTICLE V. TERM OF AGREEMENT

1. Unless earlier terminated pursuant to Article X below, this Agreement shall remain in effect through December 30, 2001, subject to the right of either party to terminate in accordance with Article X hereof and may be renewed by mutual agreement of the parties.
2. This MOU may be revised or modified as necessary by mutual consent of all parties through the issuance of a written amendment, signed and dated by all parties.

ARTICLE VI. KEY OFFICIALS

1. For Redwood National Park:

Andrew T. Ringgold, Superintendent
Redwood National Park
1111 Second St.
Crescent City, California 95531
(707) 464-6101

2. For California Department of Parks and Recreation

Richard C. Sermon, Superintendent
California Department of Parks and Recreation
Prairie Creek Redwoods State Park
1111 Second St.
Crescent City, California 95531
(707) 464-6101

3. For the Yurok Tribe

Susie L. Long, Chairperson
Yurok Tribe
1034 Sixth St.
Eureka, California 95501
(707) 444-0433

ARTICLE VII. PROPERTY UTILIZATION

N/A

ARTICLE VIII. PRIOR APPROVAL

N/A

ARTICLE IX. REPORTS AND/OR DELIVERABLES

N/A

ARTICLE X. TERMINATION

This Agreement may be terminated at any time by providing sixty (60) days written notice to the other parties.

ARTICLE XI. STANDARD CLAUSES**1. Civil Rights**

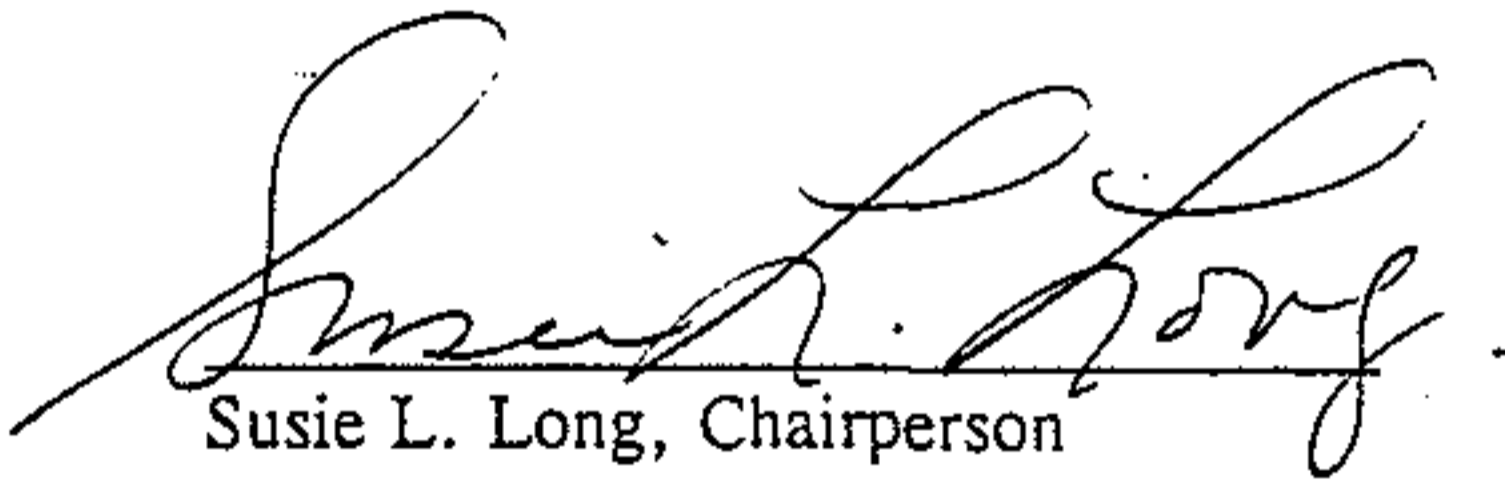
During the performance of this Agreement, the participants agree to abide by the terms of USDI-Civil Rights Assurance Certification, non-discrimination and will not discriminate against any person because of race, color, religion, sex or national origin. The participants will take affirmative action to ensure that applicants are employed without regard to their race, color, religion, sex or national origin. This does not prohibit the Yurok Tribe from preferential hiring in favor of Yurok Indians to the extent such hiring is authorized under the law.

2. Officials Not to Benefit

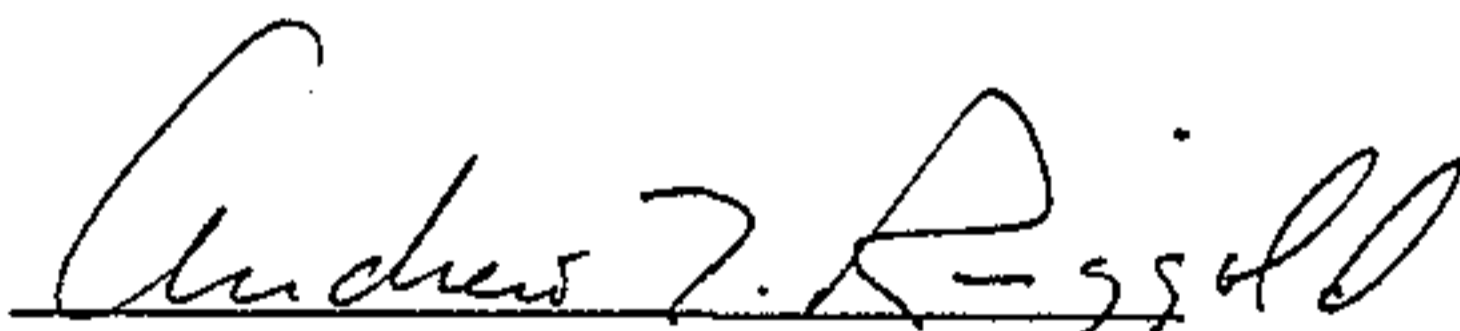
No member or delegate to Congress, or resident Commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.

ARTICLE XII. AUTHORIZING SIGNATURES


In witness hereof, the parties have signed their names and executed this Memorandum of Agreement.


Susie L. Long, Chairperson
Yurok Tribe

Date: June 11, 1996


Andrew T. Ringgold, Superintendent
Redwood National Park

Date: June 11, 1996


Richard C. Sermon, Superintendent
California Department of Parks and Recreation

Date: JUNE 11, 1996

APPENDIX E: FEDERAL ESTABLISHING LEGISLATION

Public Law 90-545

AN ACT

To establish a Redwood National Park in the State of California, and for other purposes.

October 2, 1968
[S. 2515]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, in order to preserve significant examples of the primeval coastal redwood (*Sequoia sempervirens*) forests and the streams and seashores with which they are associated for purposes of public inspiration, enjoyment, and scientific study, there is hereby established a Redwood National Park in Del Norte and Humboldt Counties, California.

Redwood National
Park, Calif.
Establishment.

SEC. 2. (a) The area to be included within the Redwood National Park is that generally depicted on the maps entitled "Redwood National Park," numbered NPS-RED-7114-A and NPS-RED-7114-B, and dated September 1968, copies of which maps shall be kept available for public inspection in the offices of the National Park Service, Department of the Interior, and shall be filed with appropriate officers of Del Norte and Humboldt Counties. The Secretary of the Interior (hereinafter referred to as the "Secretary") may from time to time, with a view to carrying out the purpose of this Act and with particular attention to minimizing siltation of the streams, damage to the timber, and assuring the preservation of the scenery within the boundaries of the national park as depicted on said maps, modify said boundaries, giving notice of any changes involved therein by publication of a revised drawing or boundary description in the Federal Register and by filing said revision with the officers with whom the original maps were filed, but the acreage within said park shall at no time exceed fifty-eight thousand acres, exclusive of submerged lands.

Boundaries.

(b) The Secretary is authorized to acquire by donation only all or part of existing publicly owned highways and roads within the boundaries of the park as he may deem necessary for park purposes. Until such highways and roads have been acquired, the Secretary may cooperate with appropriate State and local officials in patrolling and maintaining such roads and highways.

Publication in
Federal Register.

SEC. 3. (a) The Secretary is authorized to acquire lands and interests in land within the boundaries of the Redwood National Park and, in addition thereto, not more than ten acres outside of those boundaries for an administrative site or sites. Such acquisition may be by donation, purchase with appropriated or donated funds, exchange, or otherwise, but lands and interests in land owned by the State of California may be acquired only by donation.

(b) (1) Effective on the date of enactment of this Act, there is hereby vested in the United States all right, title, and interest in, and the right

to immediate possession of, all real property within the park boundaries designated in maps NPS-RED-7114-A and NPS-RED-7114-B, except real property owned by the State of California or a political subdivision thereof and except as provided in paragraph (3) of this subsection. The Secretary shall allow for the orderly termination of all operations on real property acquired by the United States under this subsection, and for the removal of equipment, facilities, and personal property therefrom.

78 Stat. 900.
16 USC 4601-7.

(2) The United States will pay just compensation to the owner of any real property taken by paragraph (1) of this subsection. Such compensation shall be paid either: (A) by the Secretary of the Treasury from money appropriated from the Land and Water Conservation Fund, including money appropriated to the Fund pursuant to section 4(b) of the Land and Water Conservation Fund Act of 1965, as amended, subject to the appropriation limitation in section 10 of this Act, upon certification to him by the Secretary of the agreed negotiated value of such property, or the valuation of the property awarded by judgment, including interest at the rate of 6 per centum per annum from the date of taking the property to the date of payment therefor; or (B) by the Secretary, if the owner of the land concurs, with any federally owned property available to him for purposes of exchange pursuant to the provisions of section 5 of this Act; or (C) by the Secretary using any combination of such money or federally owned property. Any action against the United States for the recovery of just compensation for the land and interests therein taken by the United States by this subsection shall be brought in the Court of Claims as provided in title 28, United States Code, section 1491.

68 Stat. 1241.

(3) Subsection 3(b) shall apply to ownerships of fifty acres or less only if such ownerships are held or occupied primarily for nonresidential or nonagricultural purposes, and if the Secretary gives notice to the owner within sixty days after the effective date of this Act of the application of this subsection. Notice by the Secretary shall be deemed to have been made as of the effective date of this Act. The district court of the United States for that district in which such ownerships are located shall have jurisdiction to hear and determine any action brought by any person having an interest therein for damages occurring by reason of the temporary application of this paragraph, between the effective date of this Act and the date upon which the Secretary gives such notice. Nothing in this paragraph shall be construed as affecting the authority of the Secretary under subsections (a) and (c) of this section to acquire such areas for the purposes of this Act.

(c) If any individual tract or parcel of land acquired is partly inside and partly outside the boundaries of the park or the administrative site the Secretary may, in order to minimize the payment of severance damages, acquire the whole of the tract or parcel and exchange that part of it which is outside the boundaries for land or interests in land inside the boundaries or for other land or interests in land acquired pursuant to this Act, and dispose of so much thereof as is not so utilized in accordance with the provisions of the Federal Property and Administrative Services Act of 1949 (63 Stat. 377), as amended (40 U.S.C. 471 et seq.). The cost of any land so acquired and disposed of shall not be charged against the limitation on authorized appropriations contained in section 10 of this Act.

(d) The Secretary is further authorized to acquire, as provided in subsection (a) of this section, lands and interests in land bordering both sides of the highway between the present southern boundary of Prairie Creek Redwoods State Park and a point on Redwood Creek

near the town of Orick to a depth sufficient to maintain or to restore a screen of trees between the highway and the land behind the screen and the activities conducted thereon.

(e) In order to afford as full protection as is reasonably possible to the timber, soil, and streams within the boundaries of the park, the Secretary is authorized, by any of the means set out in subsections (a) and (c) of this section, to acquire interests in land from, and to enter into contracts and cooperative agreements with, the owners of land on the periphery of the park and on watersheds tributary to streams within the park designed to assure that the consequences of forestry management, timbering, land use, and soil conservation practices conducted thereon, or of the lack of such practices, will not adversely affect the timber, soil, and streams within the park as aforesaid. As used in this subsection, the term "interests in land" does not include fee title unless the Secretary finds that the cost of a necessary less-than-fee interest would be disproportionately high as compared with the estimated cost of the fee. No acquisition other than by donation shall be effectuated and no contract or cooperative agreement shall be executed by the Secretary pursuant to the provisions of this subsection until sixty days after he has notified the President of the Senate and the Speaker of the House of Representatives of his intended action and of the costs and benefits to the United States involved therein.

"Interests in land."

SEC. 4. (a) The owner of improved property on the date of its acquisition by the Secretary under this Act may, as a condition of such acquisition, retain for himself and his heirs and assigns a right of use and occupancy of the improved property for noncommercial residential purposes for a definite term of not more than twenty-five years or, in lieu thereof, for a term ending at the death of the owner or the death of his spouse, whichever is later. The owner shall elect the term to be reserved. Unless the property is wholly or partially donated to the United States, the Secretary shall pay the owner the fair market value of the property on the date of acquisition minus the fair market value on that date of the right retained by the owner. A right retained pursuant to this section shall be subject to termination by the Secretary upon his determination that it is being exercised in a manner inconsistent with the purpose of this Act, and it shall terminate by operation of law upon the Secretary's notifying the holder of the right of such determination and tendering to him an amount equal to the fair market value of that portion of the right which remains unexpired.

(b) The term "improved property", as used in this section, means a detached, noncommercial residential dwelling, the construction of which was begun before October 9, 1967, together with so much of the land on which the dwelling is situated, the said land being in the same ownership as the dwelling, as the Secretary shall designate to be reasonably necessary for the enjoyment of the dwelling for the sole purpose of noncommercial residential use, together with any structures accessory to the dwelling which are situated on the land so designated.

"Improved property."

(c) The Secretary shall have, with respect to any real property acquired by him in sections 5 and 8, township 13 north, range 1 east, Humboldt meridian, authority to sell or lease the same to the former owner under such conditions and restrictions as will assure that it is not utilized in a manner or for purposes inconsistent with the national park.

SEC. 5. In exercising his authority to acquire property by exchange, the Secretary may accept title to any non-Federal property within the boundaries of the park, and outside of such boundaries within the limits prescribed in this Act. Notwithstanding any other provision of law, the Secretary may acquire such property from the grantor by

exchange for any federally owned property under the jurisdiction of the Bureau of Land Management in California, except property needed for public use and management, which he classifies as suitable for exchange or other disposal, or any federally owned property he may designate within the Northern Redwood Purchase Unit in Del Norte County, California, except that section known and designated as the Yurok Experimental Forest, consisting of approximately nine hundred and thirty-five acres. Such federally owned property shall also be available for use by the Secretary in lieu of, or together with, cash in payment of just compensation for any real property taken pursuant to section 3(b) of this Act. The values of the properties so exchanged either shall be approximately equal or, if they are not approximately equal, the value shall be equalized by the payment of cash to the grantor or to the Secretary as the circumstances require. Through the exercise of his exchange authority, the Secretary shall, to the extent possible, minimize economic dislocation and the disruption of the grantor's commercial operations.

SEC. 6. Notwithstanding any other provision of law, any Federal property located within any of the areas described in sections 2 and 3 of this Act may, with the concurrence of the head of the agency having custody thereof, be transferred without consideration to the administrative jurisdiction of the Secretary for use by him in carrying out the provisions of this Act.

SEC. 7. (a) Notwithstanding any other provision of law, the Secretary shall have the same authority with respect to contracts for the acquisition of land and interests in land for the purposes of this Act as was given the Secretary of the Treasury for other land acquisitions by section 34 of the Act of May 30, 1908 (35 Stat. 545; 40 U.S.C. 261), and the Secretary and the owner of land to be acquired under this Act may agree that the purchase price will be paid in periodic installments over a period that does not exceed ten years, with interest on the unpaid balance thereof at a rate which is not in excess of the current average market yield on outstanding marketable obligations of the United States with remaining periods to maturity comparable to the average maturities on the installments.

(b) Judgments against the United States for amounts in excess of the deposit in court made in condemnation actions shall be subject to the provisions of section 1302 of the Act of July 27, 1956 (70 Stat. 694), as amended (31 U.S.C. 724a), and the Act of June 25, 1948 (62 Stat. 979), as amended (28 U.S.C. 2414, 2517).

SEC. 8. The present practice of the California Department of Parks and Recreation of maintaining memorial groves of redwood trees named for benefactors of the State redwood parks shall be continued by the Secretary in the Redwood National Park.

SEC. 9. The Secretary shall administer the Redwood National Park in accordance with the provisions of the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1-4), as amended and supplemented.

SEC. 10. There are hereby authorized to be appropriated \$92,000,000 for land acquisition to carry out the provisions of this Act.

Approved October 2, 1968.

75 Stat. 415.

Appropriation
authorization.

PUBLIC LAW 95-250—MAR. 27, 1978

92 STAT. 163

Public Law 95-250
95th Congress

An Act

To amend the Act of October 2, 1968, an Act to establish a Redwood National Park in the State of California, and for other purposes.

Mar. 27, 1978

[H.R. 3813]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Redwood
National Park,
expansion.
Employment
program.

TITLE I

SEC. 101. (a) In order to protect existing irreplaceable Redwood National Park resources from damaging upslope and upstream land uses, to provide a land base sufficient to insure preservation of significant examples of the coastal redwood in accordance with the original intent of Congress, and to establish a more meaningful Redwood National Park for the use and enjoyment of visitors, the Act entitled "An Act to establish a Redwood National Park in the State of California, and for other purposes", approved October 2, 1968 (82 Stat. 931), is amended as follows:

16 USC 79a.
Boundaries.
16 USC 79b.

(1) In subsection 2(a) after "September 1968," insert "and the area indicated as 'Proposed Additions' on the map entitled 'Additional Lands, Redwood National Park, California', numbered 167-80005-D and dated March 1978,".

(2) In section 2, subsection (a), delete "fifty-eight thousand" and substitute "one hundred and six thousand" and delete the period at the end of the subsection and add "and publicly owned highways and roads." In section 2, subsection (b), delete "by donation only". At the end of section 2, insert the following new subsection "(c)":

"(c) Within the area outside the boundaries of Redwood National Park indicated as the 'Park Protection Zone' on the map entitled 'Proposed Additions, Redwood National Park, California', numbered 167-80005-D and dated March 1978, the Secretary is authorized to acquire lands and interests in land: *Provided*, That lands may be acquired from a willing seller or upon a finding by the Secretary that failure to acquire all or a portion of such lands could result in physical damage to park resources and following notice to the Committee on Energy and Natural Resources of the United States Senate and the Committee on Interior and Insular Affairs of the House of Representatives. Any lands so acquired shall be managed in a manner which will maximize the protection of the resources of Redwood National Park, and in accordance with the Act of October 21, 1976 (90 Stat. 2743). Acquisition of a parcel of land under the authority of this subsection shall not as a result of such acquisition diminish the right of owners of adjacent lands to the peaceful use and enjoyment of their land and shall not confer authority upon the Secretary to acquire additional lands except as provided in this subsection."

Park Protection
Zone, land
acquisition.

Notice to
congressional
committees.

43 USC 1701
note.

(3) In subsection 3(a), delete the period at the end of the second sentence and add the following: "which donation of lands or interest in lands may be accepted in the discretion of the Secretary subject to such preexisting reverts and other conditions as may appear in the

16 USC 79c.

title to these lands held by the State of California, and such other reverters and conditions as may be consistent with the use and management of the donated lands as a portion of Redwood National Park. Notwithstanding any other provision of law, the Secretary may expend appropriated funds for the management of and for the construction, design, and maintenance of permanent improvements on such lands and interests in land as are donated by the State of California in a manner not inconsistent with such reverters and other conditions.”

Vested and
possessory rights
in certain real
property.
16 USC 79c.

(4) In subsection 3(b)(1), after “NPS-RED-7114-B”, insert “and effective on the date of enactment of this phrase, there is hereby vested in the United States all right, title, and interest in, and the right to immediate possession of, all real property within the area indicated as ‘Proposed Additions’ on the map entitled ‘Additional Lands, Redwood National Park, California’, numbered 167-80005-D and dated March 1978, and all right, title, and interest in, and the right to immediate possession of the down tree personal property (trees severed from the ground by man) severed prior to January 1, 1975, or subsequent to January 31, 1978, within the area indicated as ‘Proposed Additions’ on the map entitled ‘Additional Lands, Redwood National Park, California’, numbered 167-80005-D and dated March 1978.”

At the end of subsection 3(b)(1), insert the following new paragraphs: “Down tree personal property severed subsequent to December 31, 1974, and prior to February 1, 1978 may be removed in accordance with applicable State and Federal law, or other applicable licenses, permits, and existing agreements, unless the Secretary determines that the removal of such down timber would damage second growth resources or result in excessive sedimentation in Redwood Creek: *Provided, however,* That down timber lying in stream beds may not be removed without permission of the Secretary: *Provided,* That such removal shall also be subject to such reasonable conditions as may be required by the Secretary to insure the continued availability of raw materials to Redwoods United, Incorporated, a nonprofit corporation located in Manila, California.

“The Secretary shall permit, at existing levels and extent of access and use, continued access and use of each acquired segment of the B line, L line, M line, and K and K roads by each current affected woods employer or its successor in title and interest: *Provided,* That such use is limited to forest and land management and protection purposes, including timber harvesting and road maintenance. The Secretary shall permit, at existing levels and extent of access and use, continued access and use of acquired portions of the Bald Hills road by each current affected woods employer or its successor in title and interest: *Provided further,* That nothing in this sentence shall diminish the authority of the Secretary to otherwise regulate the use of the Bald Hills road.”

Just
compensation.
Jurisdiction.
16 USC 79c.

(5) In subsection 3(b)(2), delete the last sentence and add the following sentences at the end of the paragraph: “Any action against the United States with regard to the provisions of this Act and for the recovery of just compensation for the lands and interests therein taken by the United States, and for the down tree personal property taken, shall be brought in the United States district court for the district where the land is located without regard to the amount claimed. The United States may initiate proceedings at any time seeking a determination of just compensation in the district court in the manner provided by sections 1358 and 1403 of title 28, United States Code, and may deposit in the registry of the court the estimated just compensation, or a part thereof, in accordance with the procedure gen-

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erally described by section 258a of title 40, United States Code. Interest shall not be allowed on such amounts as shall have been paid into the court. In the event that the Secretary determines that the fee simple title to any property (real or personal) taken under this section is not necessary for the purposes of this Act, he may, with particular attention to minimizing the payment of severance damages and to allow for the orderly removal of down timber, revest title to such property subject to such reservations, terms, and conditions, if any, as he deems appropriate to carry out the purposes of this Act, and may compensate the former owner for no more than the fair market value of the rights so reserved, except that the Secretary may not revest title to any property for which just compensation has been paid; or, the Secretary may sell at fair market value without regard to the requirements of the Federal Property and Administrative Services Act of 1949, as amended, such down timber as in his judgment may be removed without damage to the park, the proceeds from such sales being credited to the Treasury of the United States. If the State of California designates a right-of-way for a bypass highway around the eastern boundary of Prairie Creek Redwood State Park prior to October 1, 1984, the Secretary is authorized and directed to acquire such lands or interests in lands as may be necessary for such a highway and, subject to such conditions as the Secretary may determine are necessary to assure the adequate protection of Redwood National Park, shall thereupon donate the designated right-of-way to the State of California for a new bypass highway from a point south of Prairie Creek Redwood State Park through the drainage of May Creek and Boyes Creek to extend along the eastern boundary of Prairie Creek Redwood State Park within Humboldt County. Such acreage as may be necessary in the judgment of the Secretary for this conveyance, and for a buffer thereof, shall be deemed to be a publicly owned highway for purposes of section 101(a)(2) of this amendment effective on the date of enactment of this section."

(6) In subsection 3(e), delete "sixty days" in the last sentence and add the following sentences at the end of the subsection: "Effective on the date of enactment of this sentence, there are made available from the amounts provided in section 10 herein or as may be hereafter provided such sums as may be necessary for the acquisition of interests in land. Effective on October 1, 1978, there are authorized to be appropriated such sums as may be necessary for the implementation of contracts and cooperative agreements pursuant to this subsection: *Provided*, That it is the express intent of Congress that the Secretary shall to the greatest degree possible insure that such contracts and cooperative agreements provide for the maximum retention of senior employees by such owners and for their utilization in rehabilitation and other efforts. The Secretary, in consultation with the Secretary of Agriculture, is further authorized, pursuant to contract or cooperative agreement with agencies of the Federal Executive, the State of California, any political or governmental subdivision thereof, any corporation, not-for-profit corporation, private entity or person, to initiate, provide funds, equipment, and personnel for the development and implementation of a program for the rehabilitation of areas within and upstream from the park contributing significant sedimentation because of past logging disturbances and road conditions, and, to the extent feasible, to reduce risk of damage to streamside areas adjacent to Redwood Creek and for other reasons: *Provided further*, That authority to make payments under this subsection shall be effective only to such extent or in such amounts as are provided in advance in appro-

Interest.
Title revestment.

Down timber,
sale.
40 USC 471 note.

Highway right-of-
way, land
acquisition.

Land acquisition,
availability of
funds.
16 USC 79c.
16 USC 79j.

Contracts and
agreements,
appropriation
authorization.
Retention of
senior employees.

Land
rehabilitation,
contracts and
cooperative
agreements.

Erosion and
sedimentation
study.

16 USC 1a-1.

16 USC 1b, 1c.

16 USC 1.

Effective date.
16 USC 79c-1.
16 USC 79a.

16 USC 79c.

Economic impact
study.
16 USC 79k.

priation Acts. Such contracts or cooperative agreements shall be subject to such other conditions as the Secretary may determine necessary to assure the adequate protection of Redwood National Park generally, and to provide employment opportunities to those individuals affected by this taking and to contribute to the economic revival of Del Norte and Humboldt Counties in northern California. The Secretary shall undertake and publish studies on erosion and sedimentation originating within the hydrographic basin of Redwood Creek with particular effort to identify sources and causes, including differentiation between natural and man-aggravated conditions, and shall adapt his general management plan to benefit from the results of such studies. The Secretary, or the Secretary of Agriculture, where appropriate, shall also manage any additional Federal lands under his jurisdiction that are within the hydrographic basin of Redwood Creek in a manner which will minimize sedimentation which could affect the park, and in coordination with plans for sediment management within the basin. To effectuate the provisions of this subsection, and to further develop scientific and professional information and data concerning the Redwood Forest ecosystem, and the various factors that may affect it, the Secretary may authorize access to the area subject to this subsection by designated representatives of the United States."

(b) The first section of the Act of August 18, 1970 (84 Stat. 825), is amended by adding the following: "Congress further reaffirms, declares, and directs that the promotion and regulation of the various areas of the National Park System, as defined in section 2 of this Act, shall be consistent with and founded in the purpose established by the first section of the Act of August 25, 1916, to the common benefit of all the people of the United States. The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress."

(c) Notwithstanding any provision of the Act of October 2, 1968, supra, the vesting in the United States of all right, title, and interest in, and the right to immediate possession of, all real property and all down tree personal property within the area indicated as "Proposed Additions" on the map entitled "Additional Lands, Redwood National Park, California," numbered 167-80005-D and dated March 1978, as established by subsection (a) (4) of the first section of this Act, shall be effective on the date of enactment of this section. The provisions of subsection 3(b) (3) of the Act of October 2, 1968, supra, shall also relate to the effective date of this section. From the appropriations authorized for fiscal year 1978 and succeeding fiscal years such sums as may be necessary may be expended for the acquisition of lands and interests in lands, and down tree personal property, authorized to be acquired, or acquired, pursuant to the provisions of this Act.

SEC. 102. (a) The Secretary, in consultation with the Secretaries of Agriculture, Commerce, and Labor, shall conduct an analysis of appropriate Federal actions that may be necessary or desirable to mitigate any adverse economic impacts to public and private segments of the local economy, other than the owners of properties taken by this Act, as a result of the addition of property to Redwood National Park under the first section of this Act. The Secretaries shall also consider the benefits of making grants or entering into contracts or cooperative agreements with the State of California or Del Norte and Humboldt

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Counties as provided by subsection (b) for the purpose of development and implementation of a program of forest resource improvement and utilization, including, but not limited to, reforestation, erosion control, and other forest land conservation measures, fisheries and fish and wildlife habitat improvements, and wood energy facilities. Not later than January 1, 1979, the Secretary shall submit to the Speaker of the House of Representatives and the President of the Senate a report of his analysis, including his recommendations with respect to actions that should be taken to mitigate any significant short-term and long-term adverse effects on the local economy caused by such addition.

Report, submittal to Congress.

(b) The Secretary of Commerce and the Secretary of Labor, in consultation with the Secretary, and pursuant to his study, shall apply such existing programs as are necessary and appropriate to further mitigate identified employment and other adverse economic impacts on public and private segments of the local economy, other than with regard to the payment of just compensation to the owners of properties taken by this Act and by the Act of October 2, 1968, *supra*. In addition to the land rehabilitation and employment provisions of this Act, which should have a substantial positive economic effect on the local economy, the Secretaries of Commerce and Labor are further authorized and directed to implement existing authorities to establish employment programs, pursuant to such grants, contracts and cooperative agreements with agencies of the Federal Executive, the State of California, any political or governmental subdivision thereof, any corporation, not-for-profit corporation, private entity or person, for the development and implementation of such programs, as, in the discretion of the Secretaries of Commerce and Labor, may be necessary to provide employment opportunities to those individuals affected by this taking and to contribute to the economic revival of Del Norte and Humboldt Counties, in northern California. Effective on October 1, 1978, there are authorized such sums as may be necessary to carry out the employment and economic mitigation provisions of this Act: *Provided*, That the authority to make payments under this section shall be effective only to such extent or in such amounts as are provided in advance in appropriation Acts.

Employment and economic mitigation programs.

16 USC 79a.

Appropriation authorization.

(c) The Secretary of Agriculture within one year after the date of enactment of this Act, shall prepare and transmit to Congress a study of timber harvest scheduling alternatives for the Six Rivers National Forest. Such alternatives shall exclude the timber inventories now standing on units of the Wilderness Preservation System and shall be consistent with laws applicable to management of the national forests. In developing the alternatives, the Secretary shall take into consideration economic, silvicultural, environmental, and social factors.

Timber harvest study, Six Rivers National Forest. 16 USC 79k note. Transmittal to Congress.

PREFERENTIAL HIRING

Sec. 103. (a) In order to utilize the skills of individuals presently working in the woods and in the mills to the greatest degree possible to both ease the personal economic effects of this taking, and to assist in the necessary rehabilitation, protection, and improvement of lands acquired by this Act through implementation of sound rehabilitation and land use practices, the Secretary shall have power to appoint and fix the compensation of seven full-time and thirty-one temporary personnel to assist in carrying out such programs necessary for the protection and enhancement of Redwood National Park. In filling these positions, preference shall be given to affected employees (as defined in title II of this Act) for a period ending on September 30, 1984, notwithstanding applicable civil service laws and regulations.

16 USC 79l.

(b) In order to effectively administer the expanded Redwood National Park created by this Act in a manner that will provide maximum protection to its resources and to provide for maximum visitor use and enjoyment to ease the local economic effects of this taking, the Secretary shall have power to appoint and fix the compensation of two full-time and twenty temporary employees in the competitive service. In filling these positions, preference shall be given to affected employees (as defined in title II) for a period ending on September 30, 1984, notwithstanding applicable civil service laws and regulations. The Secretary shall further have power to appoint and fix the compensation of an additional thirty-two full-time and forty temporary employees in the competitive service as provided by this subsection at the time of the donation of those park lands or interests in land owned by the State of California as are within the boundaries of Redwood National Park as provided herein. In filling these positions, preference shall be given to those State employees affected by this transfer for a period not to exceed six years from the date of transfer; permanent State civil service employees shall be provided the opportunity to transfer to a comparable Federal civil service classification notwithstanding applicable civil service laws and regulations.

Civilian jobs.

(c) An affected employee shall be given full consideration for certain civilian jobs as provided in this section both with the Federal Government and with those private employers that have certain undertakings or programs that involve Federal participation or approval for the period beginning on the date of enactment of this Act and ending September 30, 1984, if the positions will be primarily located in Humboldt or Del Norte Counties or other counties in California adjacent thereto, and if the employee is otherwise qualified under this section.

Notice, job availability.

(d)(1) Any Federal agency that is creating or filling a civilian Federal job that is within the scope of clause (2)(A) of this subsection, pursuant to contract, civil service merit system, or otherwise, that will be primarily located in Humboldt or Del Norte Counties, California, or other counties in California adjacent thereto, must provide notice in advance of the availability of that job and must provide qualified affected employee applicants for these positions with full consideration for these positions if the further conditions set forth in clause (2)(B) of this subsection are met. The notice required by this paragraph shall be as provided by applicable law and regulation through the offices of the Employment and Training Services located in Humboldt and Del Norte Counties, California, and through such other means as are likely to gain the attention of affected employees.

Consideration for employment, conditions.

(2) Consideration for employment under this section shall be provided under the following conditions:

(A) the job involves skills and training that could reasonably be expected to have been gained by individuals who have been employed as logging and related woods employees or sawmill, plywood, and other wood processing employees, or office employees, or that can reasonably be expected to be gained while so employed, or pursuant to retraining as provided herein; and

(B) the applicant has the ability, or can reasonably be expected to have the ability after appropriate training of reasonable duration as further provided herein, to perform the duties of the job: *Provided*, That the full consideration shall not be required with respect to those affected employee applicants requiring training

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in a situation where the schedule for completion of the work is such that the period during which said employee can reasonably be expected to work following completion of training is determined by the Secretary to be incommensurate with the time and funds required to provide said employee with the necessary training.

(e) (1) Any Federal agency involved in the manner provided herein with a private employer responsible for filing an employment position that is within the scope of clause (2) (A) of subsection (d), above, that will be primarily located in Humboldt or Del Norte Counties, or other counties in California adjacent thereto, is directed to require that any Federal contracts, grants, subsidies, loans, or other forms of funding assistance, and any Federal lease, permit, license, certificate, or other entitlement for use, not constituting an existing property right as of the date of enactment of this Act, that is a condition to or a requirement of the conduct of harvesting and related activities or replanting and land rehabilitation or the conduct of wood processing and related activities or the conduct of highway construction and related activities shall be subject to and conditioned upon said private employer giving full consideration to affected employees as provided herein.

Private employers.

(2) Any private employer who participates with a Federal agency in the manner described above and who is, accordingly, subject to the requirements as provided herein, shall—

(A) provide notice of the availability of those jobs described in subsection (d) (2) (A) in the manner generally provided by subsection (d) (1); and

(B) provide full consideration to qualified affected employee applicants for these positions if the further conditions established by clause (2) (B) of subsection (d) are met.

(f) The Secretary is directed to seek and authorized to enter into agreements with affected employers and industry employers providing that full consideration shall be given with respect to the employment of affected employees who had been employed by affected employers in jobs that may become available in Humboldt and Del Norte Counties and other counties adjacent thereto. The execution and carrying out of such an agreement, or the giving of full consideration to the employment of affected employees under subsection (c) of this section, shall not subject an employer to any additional liability or obligations under any Federal or State equal employment law, rule, regulation, or order.

Employer agreements.

(g) (1) The Secretary, except as otherwise provided, shall be responsible for the implementation of this section and—

(A) is authorized and directed to make needed training available, upon application, to an affected employee applicant who, although not presently qualified for a position, can be reasonably expected to be qualified after appropriate training;

Training.

(B) is authorized to take such actions as may be necessary to ensure that an affected employee is not denied full consideration because of the need for training where there is no substantial reason to believe that the applicant would be unable to perform the duties of the job after proper training. If the job is one which must be filled while the affected employee would be in training, the Secretary shall encourage the employer to fill the job only on a temporary basis subject to the successful completion of the training by the affected employee;

(C) shall require that, in a case in which two or more affected

Greatest creditable service preference.

- employee applicants have approximately equal qualifications for a job for which they are to receive full consideration, that applicant with the greatest creditable service shall be given preference among those applicants entitled to full consideration; and
- Noncompliance.** (D) upon the filing of a complaint by an employee who alleges that said employee's rights to full consideration were disregarded, the Secretary shall make a finding on the merits of such complaint. If it is determined that there has been noncompliance with this section, the Secretary shall take such action as may be appropriate to correct the situation.
- Job opening, agency notification.** (2) To assist in implementing this section, agencies shall notify the Secretary, in advance, of any job opening as provided for by subsection (d) and of any Federal commitment as provided for by subsection (e).
- (3) The Secretary shall—
- (A) seek the cooperation of the State of California and the county and local governments within Humboldt and Del Norte Counties in the implementation of the provisions of this section and in the adoption of similar provisions for full consideration of affected employees with regard to State, county, and local jobs and activities; and
- Union liaison.** (B) appoint, from among nominees proposed by certified or recognized unions representing employees, a person or persons who shall serve as the Secretary's liaison with employees and their union and as consultant to the Secretary with regard to the administration of those provisions of this Act for which the Secretary is responsible.
- Judicial review.** (h) An employee, a group of employees, a certified or recognized union, or an authorized representative of such employee or group, aggrieved by any determination by the Secretary under this Act shall be entitled to judicial review of such determination in the same manner and under the same conditions as provided by section 250 of The Trade Act of 1974 (88 Stat. 2029).
- 19 USC 2322.** (i) Nothing in this section shall be construed to affect any additional or alternative rights under a law, regulation, or contract (including, but not limited to, veteran preference and contracts between private employers and unions) in effect as of the date of enactment of this Act, and the implementation of this section shall be carried out in accord with applicable civil service laws and regulations except as otherwise provided for in this section. Employees appointed to Federal jobs pursuant to this section shall have their compensation fixed at rates not to exceed that now or hereafter prescribed for the highest rate of grade 15 of the General Schedule under section 5332 of title 5, United States Code.
- Annual report, submittal to Congress. 16 USC 79m.** SEC. 104. (a) The Secretary shall submit an annual written report to the Congress on January 1, 1979, and annually thereafter for ten years, reporting on the status of payment by the Secretary for real property acquired pursuant to section 101(a)(4) and section 101(a)(2) of this amendment; the status of the actions taken regarding land management practices and watershed rehabilitation efforts authorized by section 101(a)(6) and section 102(b) of this amendment; the status of the efforts to mitigate adverse economic impacts as directed by this Act; this status of National Park Service employment requirements as authorized by section 103 of this amendment; the status of the new bypass highway and of the agreement for the donation of the

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State park lands as contemplated by section 101(a)(5) of this amendment; and, the status of the National Park Service general management plan for the park.

(b) No later than January 1, 1980, the Secretary shall submit to the Committee on Interior and Insular Affairs of the House of Representatives, and to the Committee on Energy and Natural Resources of the Senate, a comprehensive general management plan for Redwood National Park, to include but not be limited to the following:

General management plan, submittal to congressional committees.

(1) the objectives, goals, and proposed actions designed to assure the preservation and perpetuation of a natural redwood forest ecosystem;

(2) the type and level of visitor use to be accommodated by the park, by specific area, with specific indications of carrying capacities consistent with the protection of park resources;

(3) the type, extent, and estimated cost of development proposed to accommodate visitor use and to protect the resource, to include anticipated location of all major development areas, roads, and trails; and

(4) the specific locations and types of foot trail access to the Tall Trees Grove, of which one route shall, unless shown by the Secretary to be inadvisable, principally traverse the east side of Redwood Creek through the essentially virgin forest, connecting with the roadhead on the west side of the park east of Orick.

SEC. 105. Effective on October 1, 1978, there are hereby authorized to be appropriated \$33,000,000 to carry out the rehabilitation provisions of this Act.

Appropriation authorization. 16 USC 79n.

SEC. 106. (a) Notwithstanding any contrary provision of the Act entitled "An Act to provide for certain payments to be made to local governments by the Secretary of the Interior based upon the amount of certain public lands within the boundaries of such locality", approved October 20, 1976 (90 Stat. 2662), the Secretary is authorized and directed to make payments on a fiscal year basis to each unit of local government, in the manner provided by the Act of October 20, 1976, in which lands owned by the United States within Redwood National Park are located. Such payments may be used for any governmental purpose. The amount of such payments shall be computed as provided in subsections (b) and (c).

Payments to local governments. 16 USC 79o.

(b) Payment made for any fiscal year to a unit of local government shall include that amount determined pursuant to the provisions of section 2 of the Act of October 20, 1976.

31 USC 1601.

(c) Payment made for any fiscal year to a unit of local government shall also include that amount determined pursuant to the provisions of section 3 of the Act of October 20, 1976: *Provided, however*, That any amount computed as provided by section 3(c)(1) of the Act of October 20, 1976, but not paid because of the limitation of subsection (c)(2) and subsection (d) of that section shall be carried forward and shall be applied to future years in which this portion of the total payment would not otherwise equal the amount of real property taxes assessed and levied on such property during the last full fiscal year before the fiscal year in which such land or interest was acquired for addition to Redwood National Park until such amount is exhausted.

31 USC 1602.

31 USC 1603. Payment carry forward.

31 USC 1602.

(d) The Redwoods Community College District shall be considered as an affected school district for purpose of section 3(a) of the Act of October 20, 1976, as amended herein.

31 USC 1602. Redwoods United, Inc., Manila, Calif. 16 USC 79p.

SEC. 107. The Secretary is further authorized, and the Congress specifically directs that it shall be a purpose of this Act, that the com-

munity services and employment opportunities provided by Redwoods United, Incorporated, a nonprofit corporation located in Manila, California, shall be maintained at the present rate of employment to the greatest degree practicable.

Just
compensation.
16 USC 79q.

SEC. 108. The Congress further acknowledges and directs that the full faith and credit of the United States is pledged to the prompt payment of just compensation as provided for by the fifth amendment to the Constitution of the United States for those lands and properties taken by this Act.

16 USC 79k note.

SEC. 109. Unless otherwise indicated hereinbefore, a reference to the Secretary will refer to the Secretary of the Department of the Interior, except in subsections 103(d) through 103(i), where a reference to the Secretary will refer to the Secretary of the Department of Labor.

TITLE II

DEFINITIONS

SEC. 201. As used in this title, the term—

(1) "Secretary" unless otherwise indicated, means the Secretary of the Department of Labor;

(2) "expansion area" means the area indicated as "Proposed Additions" (exclusive of the park protection zone) on the map entitled "Additional Lands, Redwood National Park, Humboldt County, California", numbered 167-80005-D and dated March 1978. The number of acres authorized to be included within the expansion area is forty-eight thousand acres, as further provided herein;

(3) "employee" means a person employed by an affected employer and, with such exceptions as the Secretary may determine, in an occupation not described by section 13(a)(1) of the Fair Labor Standards Act (29 U.S.C. 213(a)(1));

(4) "contract employees" are employees performing work pursuant to a contract or agreement for services within or directly related to the expansion area between an affected contract employer and an affected woods employer;

(5) "industry employer" means a corporation, partnership, joint venture, person, or other form of business entity (including a predecessor or successor by purchase, merger, or other form of acquisition), of which a working portion or division is an affected employer;

(6) "affected employer" means a corporation, partnership, joint venture, person, or other form of business entity (including a predecessor or a successor by purchase, merger, or other form of acquisition), or a working portion or division thereof, which is engaged in the harvest of timber or in related sawmill, plywood, and other wood processing operations, and which meets the qualifications set forth in the definition of affected woods employer, affected mill employer, or affected contract employer;

(7) "affected woods employer" means an affected employer engaged in the harvest of redwood timber who owns at least 3 per centum of the number of acres authorized to be included within the expansion area on January 1, 1977, and on the date of enactment of this section: *Provided*, That an affected woods employer shall be only that major portion or division of the industry employer directly responsible for such harvesting operations;

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(8) "affected mill employer" means an affected employer engaged in sawmill, plywood, and other wood processing operations in Humboldt or Del Norte Counties in the State of California who has either (A) obtained 15 per centum or more of its raw wood materials directly from affected woods employers during calendar year 1977, or (B) is a wholly owned mill of an affected woods employer: *Provided*, That an affected mill employer shall be only that major portion or division of the industry employer directly responsible for such wood processing operations;

(9) "affected contract employer" means an affected employer providing services pursuant to contract with an affected woods employer, if at least 15 per centum of said employer's employee-hours worked during calendar year 1977 were within or directly related to the expansion area pursuant to such contract or contracts;

(10) "covered employee" means an employee who—

(A) had seniority under a collective bargaining agreement with an affected employer as of May 31, 1977, has at least twelve months of creditable service as of the date of enactment of this section, and has performed work for one or more affected employers on or after January 1, 1977, or

(B) has performed work for one or more affected employers for at least one thousand hours from January 1, 1977, through the period to the date of enactment of this section, and has a continuing employment relationship with an affected employer, as determined by the Secretary, as of the date of enactment of this section or, if laid off on or after May 31, 1977, had such a relationship as of the date of such layoff;

(11) "affected employee" means a covered employee who is either totally or partially laid off by an affected employer within a time period beginning on or after May 31, 1977, and ending September 30, 1980, unless extended, as provided in section 203, or is determined by the Secretary to be adversely affected by the expansion of the Redwood National Park. An employee shall be deemed adversely affected as of the date of the employee's layoff, downgrading, or termination;

(12) "total layoff" means a calendar week during which affected employers have made no work available to a covered employee and made no payment to said covered employee for time not worked, and "partial layoff" means a calendar week for which all pay received by a covered employee from affected employers is at least 10 per centum less than the layoff or vacation replacement benefit that would have been payable for that week had said covered employee suffered a total layoff: *Provided*, That the terms "total layoff" and "partial layoff" shall also apply to a covered employee who had received any workers' compensation benefits or unemployment compensation disability benefits after said covered employee becomes able to work and available for work and is otherwise within the meaning of total layoff and partial layoff as defined in this paragraph;

(13) "Federal agency" has the same meaning as "agency" in section 552(c) of title 5, United States Code;

(14) "suitable work" shall be defined—

5 USC 551.

(A) as set forth in the California Unemployment Insurance Code, or Federal law if applicable, unless otherwise more restrictively defined by the Secretary, taking into account the unique characteristics of logging and related work; and

(B) with respect to an employee who has completed retraining paid for by the Secretary, as a job paying no less than the prevailing wage rate in the area for the occupation for which said employee was retrained; or

(C) as a job comparable with that which said employee would be required to accept pursuant to the seniority provisions of the applicable collective-bargaining agreement (or, if not covered by such an agreement, in accordance with the usual practice of the affected employer);

(15) "seniority" with respect to an employee covered by a collective-bargaining agreement with an affected employer, shall be determined as provided in such agreement and shall be deemed to refer to company seniority, if the agreement provides for such seniority and, otherwise, to plant seniority;

(16) "continuous service" with respect to employees not having seniority under a collective-bargaining agreement with an affected employer or an industry employer shall mean a period of time measured in months equal to the sum of all hours during which the employee performed work for said employer plus all hours for which the employee received pay for time not worked divided by one hundred and seventy-three;

(17) "performed work" shall include any time during which an employee worked for an affected employer or with respect to which an employee received pay from such an employer for time not worked, and shall also include any time during which an employee would have been at work for such an employer if not for service in the armed forces, for a leave (approved by the employer) for work with an employee organization, or for a disability for which said employee received workers' compensation, disability compensation benefits provided under California law, or social security disability pension benefits: *Provided*, That contract employees shall be deemed to have performed work during the period of such service or disability only if—

(A) the employee worked within or directly related to the expansion area immediately prior to the occurrence of such service or disability and

(B) the employee returned or sought to return to work for an affected contract employer immediately after the end of the service or disability if that was prior to the date of enactment.

The term "work performed", when used in relation to a period of time, shall also be deemed to include any period during which an employee is deemed to have performed work;

(18) "terminal pay" means the payments to employees provided for in sections 207, 208, and 209 which, regardless of the designations used herein to distinguish among them are intended and shall be deemed to be severance pay and, as such, shall be treated for Federal income tax and State unemployment insurance purposes in the same manner as is provided by California State law;

(19) Notwithstanding any other provision of this Act, the Secretary shall reduce the amount of terminal pay for an employee,

Terminal pay
reductions.

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as calculated pursuant to section 207, 208, or 209, by the amount of the Federal and State income taxes which would be required to be withheld by an employer from wages equal to such terminal pay if paid to an employee with the same number of income tax exemptions as the recipient. For purposes of determining the amounts of such reductions with respect to severance payments made pursuant to sections 208 and 209, said severance payments shall be prorated over the number of weeks the equivalent sums would have been paid if the employees were eligible for and claiming the weekly layoff benefits provided in section 207. The Secretary shall withhold social security contributions from terminal pay in the same amounts as would be withheld if such pay (before the reductions provided for in this subsection) were wages and the Secretary shall make contributions on behalf of employees receiving terminal pay to the trust funds created under section 201 of the Social Security Act equal to the contributions required to be made by an employer paying wages equal to such unreduced terminal pay; and

42 USC 401.

(20) "Sixty-fifth birthday" means the last day of the month in which the sixty-fifth birthday occurs.

SEC. 202. The Secretary is authorized to develop the necessary procedures to implement this title.

AFFECTED EMPLOYEES

SEC. 203. The total or partial layoff of a covered employee employed by an affected employer during the period beginning May 31, 1977, and ending September 30, 1980, other than for a cause that would disqualify an employee for unemployment compensation, except as provided in section 205, is conclusively presumed to be attributable to the expansion of Redwood National Park: *Provided*, That the Secretary may, for good cause, extend this period for any group of covered employees by no more than one year at a time after September 30, 1980. Any covered employee laid off during that period by an affected employer shall be considered an affected employee at any time said employee is on such layoff within the period ending September 30, 1984, or, if earlier, the end of said employee's period of protection as defined herein: *Provided, however*, That the number of affected employees with respect to an affected contract employer shall be limited in any week to that number of such employees otherwise affected as provided herein that is equal to the percentage of the affected employer's employee hours during calendar year 1977 that were worked within or directly related to the expansion area.

SEC. 204. (a) The Secretary shall provide, to the maximum extent feasible, for retention and accrual of all rights and benefits which affected employees would have had in an employment with affected employers during the period in which they are affected employees. The Secretary is authorized and shall seek to enter into such agreements as he may deem to be appropriate with affected employees and employers, labor organizations representing covered employees, and trustees of applicable pension and welfare funds, or to take such other actions as he deems appropriate to provide for affected employees (including the benefits provided for in section 207(d)) the following rights and benefits:

Employee rights and benefits.

- (1) retention and accrual of seniority rights, including recall rights (or, in the case of employees not covered by collective-bargaining agreements, application of the same preferences and

privileges based upon length of continuous service as are applied under the affected employer's usual practices) under conditions no more burdensome to said employees than to those actively employed; and

(2) continuing entitlement to health and welfare benefits and accrual of pension rights and credits based upon length of employment and/or amounts of earnings to the same extent as and at no greater cost to said employees than would have been applicable had they been actively employed.

(b) The Secretary shall provide, additionally, for continuing entitlement to health and welfare benefits (other than group life and additional death, dismemberment, and loss of sight benefits) for employees who—

(1) retired from employment with an affected employer for reasons other than disability on or after May 31, 1977, but not later than September 30, 1984;

(2) are receiving pension benefits under a plan financed by industry employers;

(3) were age sixty-two or older but less than age sixty-five at the time of retirement; and

(4) are not eligible for benefits under title XVIII of the Social Security Act.

42 USC 1395.
Payments to
pension and
welfare trust
funds.

(c) The agreements described in subsection (a) of this section shall provide for the Secretary, effective October 1, 1977, to make payments on behalf of eligible affected employees including employees eligible for the benefits provided for in section 207(d) to the applicable pension and welfare trust funds and to insurance companies. Such payments may be made in the form of grants and/or contributions equivalent to the difference between the amounts payable by their affected employers and labor organizations pursuant to collective-bargaining agreements (or, in the absence of such agreements, pursuant to established practice) and the amounts that would have been paid by their affected employers and their labor organizations had said employees worked or received pay for the periods for which they receive layoff benefits: *Provided*, That no payment shall be made to a pension fund on behalf of an employee who is receiving a pension from such fund. For purposes of determining the amounts of contributions calculated on the basis of worked or compensable hours, layoff and vacation replacement benefits shall be converted into the hours they represent in accordance with regulations to be issued by the Secretary.

29 USC 1001
note.
29 USC 186.

(d) No person shall be subject to liability under the Employee Retirement Income Security Act of 1974, section 302 of the Labor-Management Relations Act, 1947, or any other law, solely by reason of the receipt of payments from the Secretary or the payment of benefits to affected employees in accordance with this section. Receipt of such payments and the payment of such benefits are deemed to be consistent with any relevant plan documents. No action taken pursuant to this section shall be deemed to place the Secretary in the position of an employer or a party in interest (including a fiduciary) for purposes of the Employee Retirement Income Security Act of 1974.

29 USC 1001
note.
Filing date.

Sec. 205. (a) An application for unemployment compensation filed by a covered employee on or after the first Monday following the date of enactment shall be deemed an application for the benefits provided by this Act.

Layoff and
vacation
replacement
benefits,
eligibility
requirements.

(b) An affected employee shall be eligible (unless said employee has received a social security retirement or disability benefit or a pension under a plan contributed to by an affected employer) for layoff and

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vacation replacement benefits, as defined herein, effective the first Monday following the date of enactment, for each week of total or partial layoff if, with respect to said week, said employee—

(1) is registered with the United States Employment and Training Service in Humboldt or Del Norte Counties or one of the adjacent counties in the State of California or at such other location as the Secretary may designate;

(2) is eligible for unemployment compensation benefits under the California Unemployment Insurance Code: *Provided*, That the Secretary is authorized and directed to provide for the payment of benefits under this title to an affected employee who is held ineligible or is disqualified for benefits under said code solely because of one or more of the following reasons: insufficient base period earnings; exhaustion of benefit rights; earnings in excess of the amount which would entitle the employee to a partial benefit for the week; the waiting week requirement; unavailability for work because of jury duty, National Guard duty, retraining authorized, financed or approved by a public agency, or because of a similar reason as determined by the Secretary; refusal of work which is not "suitable work" as defined in section 201(14); receipt of a worker's compensation or other benefit for partial disability which the employee would be entitled to receive while working; and any other cause of ineligibility with respect to which the Secretary determines that, under the circumstances, it would be unreasonable or otherwise contrary to the purpose of this Act to deny said employee a benefit provided for herein; and

(3) the employee's period of protection has not been exhausted or otherwise ended by acceptance of a severance payment.

SEC. 206. (a) The period of protection for an affected employee shall start with the beginning of the first week for which said employee is eligible to receive a layoff or vacation replacement benefit as provided by this title, and shall continue until the earliest of (i) the date said employee accepts a severance payment provided for below, (ii) a period equal to the length of the employee's creditable service is exhausted, or (iii) said employee's sixty-fifth birthday. In no event shall such period extend beyond September 30, 1984, except as provided by subsection (d) of section 207.

(b) Creditable service shall be computed as follows:

(1) a period equal to the length of an employee's seniority (or continuous service as defined herein) with said employee's last affected employer as of the date said employee's period of protection begins; plus

(2) a period equal to the sum of all prior periods during which the employee had seniority (or continuous service) with the same affected employer and with other industry employers: *Provided*, That if such seniority was broken (or such continuous service was interrupted) for more than three consecutive years for any reason other than employment with other affected or industry employers, periods of service in the Armed Forces or disabilities for which said employee received any workers' compensation benefits, unemployment compensation disability benefits, or disability benefits under the Social Security Act, any periods of seniority (or continuous service) prior to the break in seniority (or interruption in continuous service) shall be disregarded.

(c) If necessary, in order to establish an employee's creditable service, the Secretary shall request authorization to examine said employee's social security wage record and shall compute such service from it by a method to be prescribed by regulation.

Payments to ineligible or disqualified employees.

Protection period.

Creditable service, computation.

Weekly layoff
benefit,
computation.

SEC. 207. (a) Except as further provided in this section, the amount of an eligible employee's weekly layoff benefit shall be equal to (1) the annual average of all hours of work performed by said employee for the last affected employer or whom the employee worked prior to the date of enactment of this section during those three of the five calendar years immediately preceding said date during which such hours were greatest, counting hours paid for at time and a half and double time as one and one-half and two hours, respectively, multiplied by (2) the wage rate applicable, during the week for which the benefit is payable, to the highest paid job held by said employee, other than by temporary assignment, with said affected employer during the period from January 1, 1977, through the date of enactment of this section, and divided by (3) fifty-two.

(b) The weekly benefit amount for an eligible employee with less than five calendar years of employment with one affected employer immediately prior to the enactment date shall be equal to the lesser of—

(1) the average benefit that would be payable with respect to the same week to those covered employees (if they were eligible in the same week) who had five or more calendar years of employment with the same affected employer (in accord with subsection (a) of this section) whose benefit amounts are computed on the basis of the wage rate for a job the same as, or most similar to, the highest paid job said employee had held, other than by temporary assignment, with said affected employer during the period from January 1, 1977, through the date of enactment of this section, or

(2) an amount calculated by substituting in clause (1) of subsection (a) the annual average of all hours of work performed by said employee for said employer during those calendar years for which said employee had performed work and throughout which he had seniority (or continuous service).

(c) Notwithstanding subsections (a) and (b), the Secretary shall classify as a "seasonal employee" any affected employee whose highest paid job held, other than by temporary assignment, with said affected employer during the period from January 1, 1977, through the date of enactment of this section was in an occupation in which the average annual number of weeks during which work was actually performed by all covered employees employed in said occupation during the five calendar years preceding the enactment date was forty or less. With respect to such seasonal employees—

(1) the calculation of benefit amount set forth in subsection (a) shall be modified by—

(A) deducting from the hours for which said employee received pay those hours representing vacation pay and vacation pay increments and;

(B) substituting for the fifty-two provided in clause (3) of subsection (a) a divisor equal to the average annual number of weeks for which said employee performed work for an affected employer in said occupation during those three of the five calendar years immediately preceding the date of enactment during which the number of such weeks was greatest: *Provided*, That this calculation shall be modified in accord with subsection (b) with respect to those employees who had less than five calendar years of employment with one affected employer immediately prior to the date of enactment of this section.

Seasonal
employees,
classification,
benefit
computation.

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(2) the number of weekly benefits payable in any calendar year shall not exceed the annual average number of weeks for which a seasonal employee received pay from an affected employer for work performed in the employee's occupation, as established by paragraph (1) (B), and shall be payable only during those weeks of each year determined by the Secretary to be the usual season for that occupation;

(3) vacation pay and vacation pay increments shall be paid in the same amounts and at the same times of each year as they would have been paid had said employee performed work during all of the time for which said employee receives layoff benefits. Such pay is referred to herein as "vacation replacement benefits".

(d) Notwithstanding any other provision of this Act, the benefits for any affected employee who will reach the age of sixty on or before September 30, 1984, shall be extended after the end of the employee's period of protection (unless severance pay has been accepted) until the employee's sixty-fifth birthday, and shall be equal to said employee's weekly layoff benefit.

Elder employees,
extension of
protection period.

(e) The benefit amount provided by this section for any week of total or partial layoff shall be reduced by—

Benefit amount,
reduction.

(1) the full amount of any earnings, including pay for time not worked with respect to the same week, from employment obtained pursuant to section 103, or employment by employers engaged in timber harvesting, or in related sawmill, plywood, and other wood processing operations;

(2) 50 per centum of earnings and pay for time not worked from any other employer with respect to that week; and

(3) the full amount of any unemployment compensation attributable to that week.

SEC. 208. (a) An affected employee (other than a short-service employee described in subsection (a) of section 209) shall be paid severance pay in accordance with this section if said employee:

Severance pay,
eligibility.

(1) has been on a continuous layoff from employment with the employee's last affected employer for a period of at least twenty weeks subsequent to December 31, 1977;

(2) has no definite recall date for work with the affected employer by whom the employee was laid off and no offer of suitable work by any affected employer; and

(3) applies for severance pay during a week with respect to which said employee has not performed work for an affected employer: *Provided*, That this clause shall not result in denial of severance pay to an otherwise eligible employee who at the time of application is totally and permanently disabled as defined in the Social Security Act; or

(4) was permanently separated from employment with an affected employer during the period beginning May 31, 1977, and ending on the date of enactment of this Act, as a result of the closure of the mill or plant in which said employee was employed and has not, since said separation, been employed by an affected employer.

Provided, That an employee shall be deemed an affected employee for purposes of this section if said employee meets the requirements of clauses (1), (2), and (3) of section 204(b).

(b) The amount of severance pay payable to an employee shall be computed by multiplying the applicable number of weeks determined in accordance with subsection (c) by the amount of the weekly layoff

Severance pay,
amount.

benefit (without reduction for earnings or other benefits) which is payable, or would be payable if the employee were eligible, for the week in which the application was filed: *Provided*, That for a seasonal employee the amount so calculated, plus the amount of vacation replacement benefits applicable for that year shall be multiplied by the number of weeks in said employee's usual season, as determined in section 207(c), and the result divided by fifty-two.

(c) The number of weeks of severance pay shall be equal to one week for each month of the employee's creditable service up to a maximum of seventy-two weeks: *Provided*, That the severance payment to any employee shall not exceed the total amount of the weekly layoff and vacation replacement benefits which would have been payable if said employee were to be eligible for such benefits continuously from the week of application until the end of the applicable period of protection (or, in the case of an employee described in the final proviso of subsection (a), until the earlier of said employee's sixty-fifth birthday or September 30, 1984), calculated on the basis of the weekly amounts of such benefits as of the date of application for severance pay.

Protection
period,
termination.

(d) Acceptance of severance pay terminates the affected employee's period of protection and makes said employee ineligible thereafter for all other forms of terminal pay and for the protections provided in section 204, except as otherwise specifically provided in this Act.

Return-payment
agreement.

(e) Before making a severance payment to an employee, the Secretary shall obtain said employee's written agreement that, upon resumption of employment in the industry within Humboldt and Del Norte Counties and the counties adjacent thereto in the State of California prior to September 30, 1980, or such later date established by the Secretary with respect to said employee pursuant to section 203, said employee will return it in weekly installments equal to a specified percentage of the employee's earnings in the industry, which the Secretary shall set at a reasonable level. The agreement shall include authorization for the Secretary to arrange with an employer for withholding of the applicable amounts from the employee's pay.

SHORT-SERVICE EMPLOYEES

Benefits,
ineligibility.

SEC. 209. (a) Notwithstanding any other provision of this Act, an affected employee as defined in this title shall be ineligible for any benefit under this title except as provided in this section if:

(1) said employee will not reach age sixty before October 1, 1984; and

(2) said employee as of the date of becoming an affected employee, does not have service credit for pension purposes of at least five full years under a pension plan contributed to by industry employers.

Severance pay.

(b) An affected employee described in subsection (a) shall be paid severance pay in accordance with this section if said employee meets the requirements of section 208(a).

(c) Said employee shall be paid a severance payment equal to forty times the hourly wage rate applicable at the time of application for severance pay to the highest paid job held by said employee, other than by temporary assignment, during calendar year 1977, with the employee's last affected employer for each one hundred and seventy-three hours for which said employee performed work for affected employers.

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(d) Subsection (d) of section 208 shall be applicable to employees applying for and accepting severance payments pursuant to this section except that such employees shall remain eligible for allowances provided for in sections 211 and 212, and for retraining as provided for in section 210(a) and while in good faith engaged in such training shall be paid the same stipends and allowances as are generally applicable to individuals engaged in such retraining programs who are not employees as defined in this Act.

RETRAINING

SEC. 210. (a) An affected employee is eligible to apply for and the Secretary shall authorize training (including training for technical and professional occupations) at Government expense during said employee's period of protection if—

(1) the Secretary determines that there is no suitable employment available for the employee within a reasonable commuting area; and

(2) there is substantial reason to believe that the employee's employment prospects would be enhanced after successful completion of the training for which application has been filed.

(b) An affected employee engaged in training authorized by subsection (a) shall be paid layoff and vacation replacement benefits while in good faith engaged in such training and shall continue to be paid such benefits while so engaged.

Layoff and vacation replacement benefits.

SEC. 211. Upon application filed by an affected employee during said employee's period of protection, said employee shall be eligible for a job search allowance under the same terms, conditions, and amounts as provided in section 237 of the Trade Act of 1974 (19 U.S.C. 2297).

Job search allowance.

SEC. 212. (a) A relocation allowance shall be paid upon application by an affected employee during the applicable period of protection if—

Relocation allowance.

(1) the Secretary determines that said employee cannot reasonably be expected to obtain suitable work in the commuting area in which said employee resides; and

(2) the employee has obtained—

(A) suitable employment affording a reasonable expectation of long-term duration in the area in which said employee wishes to relocate; or

(B) a bona fide offer of such employment; or

(3) the employee relocated during the period beginning May 31, 1977, and ending on the date of enactment, because of acceptance of employment requiring a change in residence to a location outside the commuting area in which said employee resided immediately prior to becoming an affected employee.

(b) The Secretary shall provide the same moving expense benefits for the same purposes as are set forth in the Regional Rail Reorganization Act of 1973 (Public Law 93-236).

Moving expense benefits.
45 USC 701 note.

ADMINISTRATION

SEC. 213. (a) The Secretary shall be responsible for paying promptly all benefits and payments provided by this title.

(b) Effective October 1, 1977, there are authorized to be appropriated annually such sums as may be required to meet the obligations provided for in this title.

Appropriation authorization.

Subpena power.

(c) The Secretary shall have the authority to obtain information necessary to carry out the responsibilities created under this Act in the same manner as provided by section 249 of the Trade Act of 1974 (19 U.S.C. 2321).

(d) The Secretary shall offer all reasonable cooperation and assistance to individuals who believe they may qualify for the benefits, payments, preferential hiring rights, and other protections provided for employees under this Act. Among other things, the Secretary shall—

(1) provide all covered employees with literature stating their rights and obligations in nontechnical terms; and

(2) develop and implement procedures for the filing (including filing by mail in appropriate circumstances as determined by the Secretary) of applications, appeals, and complaints relating to the rights and entitlements established for employees by this title designed to facilitate prompt determinations and prompt payment to eligible applicants.

(e) The Secretary shall direct that notices, reports, applications, appeals, and information concerning the implementation of this title required to be filed with the Secretary shall be filed at the offices of the United States Employment and Training Service in Humboldt and Del Norte Counties of the State of California and that information required to facilitate employees' exercise of their rights under this title shall be kept available at such offices unless the Secretary shall designate additionally.

(f) In all cases where two or more constructions of the language of this title would be reasonable, the Secretary shall adopt and apply that construction which is most favorable to employees. The Secretary shall avoid inequities adverse to employees that otherwise would arise from an unduly literal interpretation of the language of this title.

Approved March 27, 1978.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 95-581 (Comm. on Interior and Insular Affairs), No. 95-581, pt. II (Comm. on Appropriations) and No. 95-931 (Comm. of Conference).

SENATE REPORTS: No. 95-528 (Comm. on Energy and Natural Resources) and No. 95-578 (Comm. on Appropriations).

CONGRESSIONAL RECORD, Vol. 124 (1978):

Jan. 31, S. 1976 considered and passed Senate.

Feb. 9, considered and passed House.

Feb. 28, considered and passed Senate, amended, in lieu of S. 1976.

Mar. 14, House agreed to conference report.

Mar. 21, Senate agreed to conference report.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 14, No. 13:

Mar. 27, Presidential statement.

APPENDIX F: CALIFORNIA PUBLIC RESOURCES CODE

CALIFORNIA PUBLIC RESOURCES CODE

DIVISION 5. PARKS AND MONUMENTS CHAPTER 1. STATE PARKS AND MONUMENTS

Article 1. State Park System SECTION 5003

5003. The department shall administer, protect, develop, and interpret the property under its jurisdiction for the use and enjoyment of the public. Except as provided in Section 18930 of the Health and Safety Code, the department may establish rules and regulations not inconsistent with law for the government and administration of the property under its jurisdiction. The department may expend all moneys of the department, from whatever source derived, for the care, protection, supervision, extension, and improvement or development of the property under its jurisdiction.

Article 1.7. Classification of Units of the State Park System SECTION 5019.50-5019.74

5019.50. All units which are or shall become a part of the state park system, except those units or parts of units designated by the Legislature as wilderness areas pursuant to Chapter 1.3 (commencing with Section 5093.30) of this division, shall be classified by the State Park and Recreation Commission into one of the categories specified in this article.

5019.53. State parks consist of relatively spacious areas of outstanding scenic or natural character, oftentimes also containing significant historical, archaeological, ecological, geological, or other such values. The purpose of state parks shall be to preserve outstanding natural, scenic, and cultural values, indigenous aquatic and terrestrial fauna and flora, and the most significant examples of such ecological regions of California as the Sierra Nevada, northeast volcanic, great valley, coastal strip, Klamath-Siskiyou Mountains, southwest mountains and valleys, redwoods, foothills and low coastal mountains, and desert and desert mountains.

Each state park shall be managed as a composite whole in order to restore, protect, and retain its native environmental complexes to the extent compatible with the primary purpose for which the park was established.

Improvements undertaken within state parks shall be for the purpose of making the areas available for public enjoyment and education in a manner consistent with the preservation of natural, scenic, cultural, and ecological values for present and future generations. Improvements may be undertaken to provide for recreational activities including, but not limited to, camping, picnicking, sightseeing, nature study, hiking, and horseback riding, so long as such improvements involve no major modification of lands, forests, or waters. Improvements which do not directly enhance the public's enjoyment of the natural, scenic, cultural, or ecological values of the resource, which are attractions in themselves, or which are otherwise available to the public within a reasonable distance outside the park, shall not be undertaken within state parks.

State parks may be established in either the terrestrial or underwater environments of the state.

5019.56. State recreation units consist of areas selected, developed, and operated to provide outdoor recreational opportunities. The units shall be designated by the commission by naming, in accordance with the provisions of Article 1 (commencing with Section 5001) and this article relating to classification.

In the planning of improvements to be undertaken within state recreation units, consideration shall be given to compatibility of design with the surrounding scenic and environmental characteristics.

State recreation units may be established in the terrestrial or underwater environments of the state and shall be further classified as one of the following types:

- (a) State recreation areas, consisting of areas selected and developed to provide multiple recreational opportunities to meet other than purely local needs. The areas shall be selected for their having terrain capable of withstanding extensive human impact and for their proximity to large population centers, major routes of travel, or proven recreational resources such as manmade or natural bodies of water. Areas containing ecological, geological, scenic, or cultural resources of significant value shall be preserved within state wildernesses, state reserves, state parks, or natural or cultural preserves.

APPENDIXES

Improvements may be undertaken to provide for recreational activities, including, but not limited to, camping, picnicking, swimming, hiking, bicycling, horseback riding, boating, waterskiing, diving, winter sports, fishing, and hunting.

Improvements to provide for urban or indoor formalized recreational activities shall not be undertaken within state recreation areas.

(b) Underwater recreation areas, consisting of areas in the underwater environment selected and developed to provide surface and subsurface water-oriented recreational opportunities, while preserving basic resource values for present and future generations.

© State beaches, consisting of areas with frontage on the ocean, or bays designed to provide swimming, boating, fishing, and other beach-oriented recreational activities. Coastal areas containing ecological, geological, scenic, or cultural resources of significant value shall be preserved within state wildernesses, state reserves, state parks, or natural or cultural preserves.

(d) Wayside campgrounds, consisting of relatively small areas suitable for overnight camping and offering convenient access to major highways.

5019.59. Historical units, to be named appropriately and individually, consist of areas established primarily to preserve objects of historical, archaeological, and scientific interest, and archaeological sites and places commemorating important persons or historic events. Such areas should be of sufficient size, where possible, to encompass a significant proportion of the landscape associated with the historical objects. The only facilities that may be provided are those required for the safety, comfort, and enjoyment of the visitors, such as access, parking, water, sanitation, interpretation, and picnicking. Upon approval by the commission, lands outside the primary historic zone may be selected or acquired, developed, or operated to provide camping facilities within appropriate historical units. Upon approval by the State Park and Recreation Commission, an area outside the primary historic zone may be designated as a recreation zone to provide limited recreational opportunities that will supplement the public's enjoyment of the unit.

Certain agricultural, mercantile, or other commercial activities may be permitted if those activities are a part of the history of the individual unit and any developments retain or restore historical authenticity. Historical units shall be named to perpetuate the primary historical theme of the individual units.

5019.62. State seashores consist of relatively spacious coastline areas with frontage on the ocean, or on bays open to the ocean, including water areas seasonally connected to the ocean, possessing outstanding scenic or natural character and significant recreational, historical, archaeological, or geological values. State seashores may include underwater areas within them, but may not be established solely in the underwater environment.

The purpose of state seashores shall be to preserve outstanding natural, scenic, cultural, ecological, and recreational values of the California coastline as an ecological region and to make possible the enjoyment of coastline and related recreational activities which are consistent with the preservation of the principal values and which contribute to the public enjoyment, appreciation, and understanding of those values.

Improvements undertaken within state seashores shall be for the purpose of making the areas available for public enjoyment, recreation, and education in a manner consistent with the perpetuation of their natural, scenic, cultural, ecological, and recreational value. Improvements which do not directly enhance the public enjoyment of the natural, scenic, cultural, ecological, or recreational values of the seashore, or which are attractions in themselves, shall not be undertaken.

5019.65. State reserves consist of areas embracing outstanding natural or scenic characteristics of state-wide significance. The purpose of a state reserve is to preserve its native ecological associations, unique faunal or floral characteristics, geological features, and scenic qualities in a condition of undisturbed integrity. Resource manipulation shall be restricted to the minimum required to negate the deleterious influence of man.

Improvements undertaken shall be for the purpose of making the areas available, on a day use basis, for public enjoyment and education in a manner consistent with the preservation of their natural features. Living and nonliving resources contained within state

reserves shall not be disturbed or removed for other than scientific or management purposes.

State reserves may be established in the terrestrial or underwater environments of the state.

5019.68. State wildernesses, in contrast with those areas where man and his own works dominate the landscape, are hereby recognized as areas where the earth and its community of life are untrammelled by man and where man himself is a visitor who does not remain. A state wilderness is further defined to mean an area of relatively undeveloped state-owned or leased land which has retained its primeval character and influence or has been substantially restored to a near-natural appearance, without permanent improvements or human habitation, other than semi-improved campgrounds, or structures which existed at the time of classification of the area as a state wilderness and which the State Park and Recreation Commission has determined may be retained and used in a manner compatible with the preservation of the wilderness environment, or primitive latrines, which is protected and managed so as to preserve its natural conditions, and which:

- (a) Appears generally to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable.
- (b) Has outstanding opportunities for solitude or a primitive and unconfined type of recreation.
- (3) Consists of at least 5,000 acres of land, either by itself or in combination with contiguous areas possessing wilderness characteristics, or is of sufficient size as to make practicable its preservation and use in an unimpaired condition.
- (d) May also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

State wildernesses may be established within the boundaries of other state park system units.

5019.71. Natural preserves consist of distinct areas of outstanding natural or scientific significance established within the boundaries of other state park system units. The purpose of natural preserves shall be to preserve such features as rare or endangered plant and animal species and their supporting ecosystems, representative examples of plant or animal communities existing in California prior to the impact of civilization, geological features illustrative of geological processes, significant fossil occurrences or geological features of cultural or economic interest, or topographic features illustrative of representative or unique biogeographical patterns. Areas set aside as natural preserves shall be of sufficient size to allow, where possible, the natural dynamics of ecological interaction to continue without interference, and to provide, in all cases, a practicable management unit. Habitat manipulation shall be permitted only in those areas found by scientific analysis to require manipulation to preserve the species or associations which constitute the basis for the establishment of the natural preserve.

5019.74. Cultural preserves consist of distinct areas of outstanding cultural interest established within the boundaries of other state park system units for the purpose of protecting such features as sites, buildings, or zones which represent significant places or events in the flow of human experience in California. Areas set aside as cultural preserves shall be large enough to provide for the effective protection of the prime cultural resources from potentially damaging influences, and to permit the effective management and interpretation of the resources. Within cultural preserves, complete integrity of the cultural resources shall be sought, and no structures or improvements which conflict with such integrity shall be permitted.

APPENDIX G: SUMMARY OF REFERENCED PLANS

INVENTORY OF FEATURES: JEDEDIAH SMITH REDWOODS STATE PARK, DEL NORTE COAST REDWOODS STATE PARK, PRAIRIE CREEK REDWOODS STATE PARK

This document, done by the California Department of Parks and Recreation in 1982 and 1983, summarizes all of information on the natural, cultural, aesthetic, and recreational resources of the three state redwood parks known at the time. It was compiled before the preparation of the *State Redwoods General Plan* (1984). The information provides a foundation of knowledge for the development of resource management goals, objectives, policies, and programs. It has served as the basis for general planning and facility development, for development of interpretive programs, and as background information for maintenance and operations. The *Inventory* also functions as a historical document that represents the knowledge that contributed to decision making in the *General Plan*.

BALD HILLS VEGETATION MANAGEMENT PLAN

Redwood National Park prepared the *Bald Hills Vegetation Management Plan and Environmental Assessment* in 1992. The park is implementing the plan through a combination of prescribed fires and cutting to remove Douglas-fir from 660 acres of Oregon white oak woodlands and 1,700 acres of existing prairies in the Bald Hills area of the national park.

The objective of Bald Hills vegetation management is to retain the diversity of plants and animals that prevailed in 1850 when Euro-American settlers first moved into the Redwood Creek basin. Since that time, livestock grazing, cultivation, introduction of exotic plants, and fire suppression reduced many of the once dominant native grassland species, and allowed Douglas-fir to encroach on the open prairies and oak woodlands. A long-term goal of vegetation management in the Bald Hills is to increase the size of the remaining prairies by 25%, which would better reflect their extent in 1850.

FIRE MANAGEMENT PLAN

In 1994 Redwood National Park prepared a *Draft Fire Management Plan* and a *Draft Environmental Assessment* on the plan. Following public comment, a *Final Fire Management Plan* and a "Finding of No Significant Impact" were issued in 1995. The plan calls for a program of prescribed fires to create a mosaic of burned and unburned areas, reduce unnatural fuel concentrations, and restore native plant communities. Prescribed fires conducted under the plan will be concentrated in the Bald Hills prairies and oak woodlands, and may include up to 3,000 acres in any one year. Burn prescriptions will define the appropriate climatic and fuel conditions and necessary fire-control personnel and equipment needed to ensure that burns are controlled and confined to the designated burn area.

The plan also proposes that the park's vegetation management program investigate the outcomes and the effectiveness of small burns in other vegetation types, including old-growth redwood forest. In 1995 the assessment began by burning 10 acres of old growth at the base of Elk Camp Prairie on the east side of the Redwood Creek basin to evaluate the effects of fires in old growth.

Finally, the plan requires that all wildfires, whether human caused or natural, be suppressed using techniques that minimize adverse impacts on sensitive cultural and natural resources.

EXOTIC PLANT MANAGEMENT PLAN

Redwood National Park issued a *Draft Exotic Plant Management Plan and Environmental Assessment* in 1994. The "Finding of No Significant Impact," which served to finalize the plan according to public comment on the draft plan, was issued in 1995. RNSP staff control exotic plant species through a combination of mechanical (physical removal), cultural (attempts to alter human behavior), biological (use of pathogens or ecological succession), and chemical (herbicides) methods. The plan lists target species to be controlled, describes a method for determining whether control will be effective, and assigns a priority for control. Techniques are recommended for controlling the 13 species that are considered to represent the greatest threat to park resources and ecological communities.

1984 REDWOOD NATIONAL PARK BACKCOUNTRY TRAIL PLAN

Completed in March 1984, this plan guides the implementation of the backcountry trail actions proposed in the 1980 *General Management Plan*. The trail plan was designed to keep total trail mileage to the minimum necessary to provide adequate recreational access to the Redwood Creek and Skunk Cabbage Creek areas of Redwood National Park. The plan proposed almost 144 miles of hiking and horse trails, of which about 68 miles have been constructed.

1995 DAVISON RANCH DEVELOPMENT CONCEPT PLAN

The Davison Ranch Development Concept Plan describes facilities for visitor use that will be constructed in and around Davison Ranch and the B-mill deck. The plan calls for 22 miles of new hiking, bicycling, and equestrian trails in the area west of Highway 101, north of Skunk Cabbage Creek, and south of Prairie Creek Redwoods State Park. A paved trail for hikers and bicyclists will be constructed parallel to Prairie Creek on an old logging road, beginning near the south end of Elk Prairie, running through the B-mill trailhead, and continuing across Prairie Creek to rejoin Highway 101 across from Berry Glen. A trailhead, picnic area, and restrooms will be constructed on the B-mill deck. The large area of asphalt on the deck will be removed, and an old stream channel will be restored. Parking areas will be constructed along both sides of Davison Road east of the Prairie Creek bridge to provide a safe place from which to see elk in the pastures.

1981 WATERSHED REHABILITATION PLAN

This plan, accompanied by an environmental assessment, addresses a rehabilitation program for up to 30,000 acres in the Redwood Creek basin that have been subjected to extensive timber harvest and logging road development. The major objectives of the program are to minimize human-induced erosion and to encourage the return of the area to a mature redwood forest ecosystem. The program described in the plan consists of several interrelated projects to be carried out over 15 years. The projects include erosion control, the planting of forest vegetation, and the removal of roads not needed for access to rehabilitation sites or for future park management. The plan identifies sites for treatment, including roads to be removed, and establishes the priorities among sites.

1983 MANAGEMENT ALTERNATIVES FOR THE REDWOOD CREEK ESTUARY

This document summarizes the research on the physical and biological functioning of the estuary and presents and analyzes interim and long-term management alternatives for the estuary. The research included seasonal patterns of changes in water quality; determination and comparison of present patterns of inundation, seasonal morphological changes, and sediment sources with historic information; and a determination of abundance, distribution, and seasonal patterns of estuary use by fish. An environmental assessment accompanied the plan to facilitate public input on how the estuary should be managed and/or rehabilitated.

APPENDIX H: CULTURAL RESOURCE COMPLIANCE

Table H-1: Cultural Resource Section 106 Compliance Requirements for Alternative Undertakings

Alternative 1: Proposed Action

Numbers in parentheses refer to the specific programmatic exclusion.

<p>Constructing parks' primary visitor center, Del Norte Coast Redwoods State Park entrance station and access road, Hiouchi area visitor center, trailheads and trails; camping and picnicking sites Landform restoration within parks' boundaries Adaptive rehabilitation of Prairie Creek Fish Hatchery Removing nonhistoric, noncontributing features from parks' potential cultural landscapes Converting the Coastal Drive to trail Rehabilitation of historic structures to meet accessibility requirements</p>	<p>Requires further SHPO/ACHP review, as well as consultation with the Yurok Tribal Heritage Preservation Officer, for all undertakings within the boundaries of the Yurok Reservation.</p>
<p>Archeological monitoring and testing (4) Stabilization of historic structures (1) Preservation maintenance of cultural resources (1) Rehabilitative work to preserve and protect cultural resources (9) Leasing of Prairie Creek Fish Hatchery (13) Erection of wayside exhibits and signs (12) Acquisition of lands or interests in lands by RNSP (5)</p>	<p>Programmatic exclusion</p>

Alternative 2: No Action

<p>Construction of campgrounds in state parks Landform restoration within parks' boundaries Adaptive rehabilitation of Prairie Creek Fish Hatchery Removing nonhistoric, noncontributing features from parks' potential cultural landscapes Rehabilitation of historic structures to meet accessibility requirements</p>	<p>Requires further SHPO/ACHP review, as well as consultation with the Yurok Tribal Heritage Preservation Officer, for all undertakings within the boundaries of the Yurok Reservation.</p>
<p>Archeological monitoring and testing (4) Stabilization of historic structures (1) Preservation maintenance of cultural resources (1) Rehabilitative work to preserve and protect cultural resources (9) Leasing of Prairie Creek Fish Hatchery (13) Erection of wayside exhibits and signs (12) Acquisition of lands or interests in lands by RNSP (5) Acquisition of lands or interests in lands by RNSP (5)</p>	<p>Programmatic exclusion</p>

Alternative 3: Preservation Emphasis

<p>Construction of trailheads and trails; camping and picnicking sites Landform restoration within parks' boundaries Relocation of segment of Newton B. Drury Scenic Parkway in Elk Prairie Adaptive rehabilitation of Prairie Creek Fish Hatchery Removing nonhistoric, noncontributing features from parks' potential cultural landscapes Converting Cal-Barrel Road, Coastal Drive, and Tall Trees access road to trails Rehabilitation of historic structures to meet accessibility requirements</p>	<p>Requires further SHPO/ACHP review, as well as consultation with the Yurok Tribal Heritage Preservation Officer, for all undertakings within the boundaries of the Yurok Reservation.</p>
<p>Archeological monitoring and testing (4) Stabilization of historic structures (1) Preservation maintenance of cultural resources (1) Rehabilitative work to preserve and protect cultural resources (9) Leasing of Prairie Creek Fish Hatchery (13) Erection of wayside exhibits and signs (12) Acquisition of lands or interests in lands by RNSP (5)</p>	<p>Programmatic exclusion</p>

Alternative 4: Visitor Use Emphasis

<p>Constructing Del Norte Coast Redwoods State Park entrance station and access road; the Hiouchi area visitor center; a small visitor center in vicinity of Mill Creek; trailheads and trails; camping and picnicking sites Landform restoration within parks' boundaries Adaptive rehabilitation of Prairie Creek Fish Hatchery Removing nonhistoric, noncontributing features from parks' potential cultural landscapes Realigning and widening the Coastal Drive Improving and paving Cal-Barrel, Howland Hills and Davison/Gold Bluffs Beach Roads, and Tall Trees and Stout Grove access roads Rehabilitation of historic structures to meet accessibility requirements</p>	<p>Requires further SHPO/ACHP review, as well as consultation with the Yurok Tribal Heritage Preservation Officer, for all undertakings within the boundaries of the Yurok Reservation.</p>
<p>Archeological monitoring and testing (4) Stabilization of historic structures (1) Preservation maintenance of cultural resources (1) Rehabilitative work to preserve and protect cultural resources (9) Leasing of Prairie Creek Fish Hatchery (13) Erection of wayside exhibits and signs (12) Acquisition of lands or interests in lands by RNSP (5)</p>	<p>Programmatic exclusion</p>

APPENDIX I: RARE, SENSITIVE, THREATENED, AND ENDANGERED SPECIES KNOWN TO OCCUR IN REDWOOD NATIONAL AND STATE PARKS

TABLE I-1. THREATENED AND ENDANGERED SPECIES KNOWN TO OCCUR IN REDWOOD NATIONAL AND STATE PARKS

NOTE: See the end of this appendix for definitions and abbreviations.

SPECIES	STATUS	KNOWN OR SUSPECTED OCCURRENCE IN PARKS	BREEDING OBSERVATIONS
BIRDS			
Northern Spotted Owl <i>Strix occidentalis caurina</i>	FT	uncommon resident in old-growth and mature second-growth forests throughout the parks	known to breed successfully in the parks
Marbled Murrelet <i>Brachyramphus marmoratus marmoratus</i>	FT, SE	common resident in old-growth forests throughout the parks; state parks are designated as critical habitat	assumed to breed successfully in the parks
Brown Pelican <i>Pelecanus occidentalis californicus</i>	FE, SE	common visitor on ocean shoreline throughout the parks	not known to breed in the parks
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i>	FT	suspected uncommon visitor on sandy beaches and coastal dunes throughout the parks throughout the year; probable former resident	no record of nesting in the parks
American Peregrine Falcon <i>Falco peregrinum anatum</i>	SE	uncommon resident on steep coastal bluffs, cliffs, and high rocky outcrops	known to breed successfully in parks
Bald Eagle <i>Haliaeetus leucocephalus</i>	FT, SE	uncommon resident along rivers, streams, and coastal lagoons	known to breed successfully in the parks
FISH			
Tidewater Goby <i>Eucyclogobius newberryi</i>	FE	suspected coastal estuaries and lagoons (recorded in 1980 survey but not observed since)	assumed to have bred successfully in Redwood Creek estuary and Freshwater Lagoon at one time
Northern California Steelhead <i>Oncorhynchus mykiss</i>	FC, CSC	streams south of the Klamath River	Redwood Creek, Prairie Creek, and tributaries
Klamath Mountains Province Steelhead <i>Oncorhynchus mykiss</i>	FC, CSC	streams north of and including the Klamath River	Klamath River, Smith River, Mill Creek, and coastal streams with suitable habitat in wet years
Coho Salmon, Southern Oregon / Northern California Coast <i>Oncorhynchus kisutch</i>	FT, CSC	streams between Cape Blanco, Curry County, Oregon, and Punta Gorda, Humboldt County, California; park streams are designated critical habitat	Smith River, Mill Creek, Redwood Creek, Prairie Creek, and larger tributaries
Chinook Salmon, Southern Oregon/California Coastal	FPT, CSC	streams from Elk River, or south to the northern cape forming San Francisco Bay	Redwood, Prairie, and Mill Creeks; Smith and Klamath Rivers
Coastal Cutthroat Trout	FC, CSC	small creek and tributaries of rivers and larger creeks	Klamath and Smith Rivers; Redwood, Prairie, and Mill Creeks, tributaries, and coastal creeks; Espa Lagoon

Appendix I: Rare, Sensitive, Threatened, and Endangered Species in Redwood National and State Parks

TABLE I-2. LISTED OR PROPOSED THREATENED AND ENDANGERED SPECIES THAT ARE FOUND NEAR REDWOOD NATIONAL AND STATE PARKS

NOTE: Species included in this table are listed or proposed as threatened or endangered but occur only casually or accidentally in the parks. See the end of this appendix for definitions and keys.

SPECIES	STATUS	HABITAT	PROBABLE OR NEAREST OCCURRENCE IN THE PARKS
INVERTEBRATES			
Oregon silverspot butterfly <i>Speyeria erene hippolyta</i>	FT	coastal scrub	Lakes Earl and Talawa, 3 miles west of Jedediah Smith Redwoods State Park
BIRDS			
Bank swallow <i>Riparia riparia</i>	ST	near marshes, streams and lakes; nests colonially in sandy stream banks	accidental in parks; record from Lagoon Creek; breeding colony along lower Smith River 2 miles west of Jedediah Smith Redwoods State Park
Great gray owl <i>Strix nebulosa</i>	SE	lodgepole pine forest and other coniferous forest types adjacent to meadows	accidental in parks; records from Prairie Creek and Enderts Beach
Aleutian Canada goose <i>Branta canadensis leucopareia</i>	FT	low elevation riverbottoms and agricultural pastures	accidental in parks; winters at Smith River riverbottoms northwest of Jedediah Smith Redwoods and Patrick's Point State Park south of the parks
MAMMALS			
Steller (=northern) Sea-Lion <i>Eumetopias jubatus</i>	FT	offshore coastal waters, flat offshore rocks, and rocky islands	offshore rocks near Trinidad and Patrick's Point State Park 15 miles south of parks; nearest breeding colony is 100 miles south of parks at Point Mendocino
REPTILES			
Leatherback sea turtle <i>Dermochelys coriacea</i>	FE	generally warmer oceans	only sick or injured animals likely to wash up on beaches; no nesting beaches known on northern Pacific Coast
Green sea turtle <i>Chelonia mydas</i> (incl. <i>agassizi</i>)	FT		
Loggerhead sea turtle <i>Caretta caretta</i>	FT		
Olive (=Pacific) ridley sea turtle <i>Lepidochelys olivacea</i>	FT		

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SPECIES	STATUS	HABITAT	PROBABLE OR NEAREST OCCURRENCE IN PARKS
PLANTS			
Western lily <i>Lilium occidentale</i>	FE	wetland in coastal scrub and coastal prairie; forest or thicket openings along the margins of ephemeral ponds and small channels; unconfirmed report in the northern part of park	Table Bluffs, south of Eureka, Humboldt County and near Crescent City, Del Norte County
McDonald's rock cress <i>Arabis macdonaldiana</i>	FE, SE	dry, rocky serpentine sites	North Fork Smith River drainage near Gasquet, Del Norte County
Menzies' wallflower <i>Erysimum menziesii</i>	FE, SE	semistabilized northern coastal dunes	30 miles south of parks, Samoa Peninsula and Lanphere-Christensen Dune Preserve, Humboldt County
Beach layia <i>Layia carnosa</i>	FE, SE	coastal dune; unconfirmed report for Freshwater Lagoon Spit	5-30 miles south of parks, perhaps at Humboldt Lagoons State Park, and Lanphere-Christensen Dune Preserve, Humboldt County

TABLE I-3. SPECIAL PLANTS, AND RARE AND SENSITIVE ANIMAL SPECIES KNOWN OR SUSPECTED TO OCCUR IN REDWOOD NATIONAL AND STATE PARKS OR VICINITY

NOTE: Redwood National and State Parks are also inhabited by, or contain suitable habitat for, species and the parks should be watched for changes in distribution or population size due to biological rarity, low numbers, limited distribution, or declining populations. "Special plants" is a broad term used to refer to all the plant taxa inventoried by the California Department of Fish and Game's Natural Diversity Base, regardless of their protection status. Also included are plant and animal populations that may be peripheral to the major portion of a taxon range but are threatened with extirpation in California, or they are associated with a seriously declining habitat such as wetlands, riparian areas, old-growth forests, or native grasslands. If these species continue to decline in numbers or distribution, special management consideration may be necessary to ensure their continuing viability and preclude trends toward endangerment that would result in state or federal listing. See the end of this appendix for definitions and keys.

SPECIES	STATUS	HABITAT	PARK LOCATION OR NEAREST KNOWN OCCURRENCE
PLANTS			
Kneeland prairie pennycress <i>Thlaspi montanum</i> var. <i>californicum</i>	FC, 1B	serpentine prairies	40 miles south of the parks in prairies around Kneeland, Humboldt County; not likely to colonize the parks
Two-flowered pea <i>Lathyrus biflorus</i>	FC, 1B	open, dry sunny slopes on cobbly, serpentine, or meta-sedimentary soils in high elevation Jeffrey pine woodland and montaine chaparral	50 miles southeast of the parks, the Lassies Special Botanical Area, and Six Rivers National Forest; not likely to colonize the parks
Wolf's evening primrose <i>Oenothera wolfii</i>	1B	coastal dunes	Enderts Beach
Pink sand verbena <i>Abronia umbellata</i> ssp. <i>brevifolia</i>	1B	coastal dunes, bluffs, and gravel roadbanks	Freshwater Lagoon Spit, mouth of Redwood Creek, and Gold Bluffs Beach
Maple-leaved checkerbloom <i>Sidalcea malachroides</i>	1B	coastal woodlands and clearings	Del Norte Coast Redwoods State Park; Mill Creek Horse Trail; and trail to Nickel Creek campground

Appendix I: Rare, Sensitive, Threatened, and Endangered Species in Redwood National and State Parks

SPECIES	STATUS	HABITAT	PARK LOCATION OR NEAREST KNOWN OCCURRENCE
PLANTS, continued			
Siskiyou checkerbloom <i>Sidalcea malvaeflora</i> ssp. <i>patula</i>	1B	open coastal forest on serpentine soils	known from Del Norte County
Western bog violet <i>Viola primulifolia</i> ssp. <i>occidentalis</i>	1B	<i>Darlingtonia</i> bogs and marshes in mixed evergreen forest below 2,500 feet in elevation	known from Del Norte County
Thurber's reed grass <i>Calamagrostis crassiglumis</i>	2	coastal dunes	near Crescent City
Siskiyou Indian paintbrush <i>Castilleja miniata</i> ssp. <i>elata</i>	2	bogs, often near serpentine	known from Del Norte County
Black crowberry <i>Empetrum nigrum</i> ssp. <i>hermaphroditum</i>	2	rocky sea cliffs in coastal scrub	known from Del Norte and Humboldt Counties
Waldo buckwheat <i>Eriogonum pendulum</i>	2	open serpentine	known from Del Norte County
Marsh pea <i>Lathyrus palustris</i>	2	moist coastal areas	last known occurrence along Tall Trees access road
Running-pine <i>Lycopodium clavatum</i>	2	moist ground in forests	Larry Damm Creek, Lost Man Creek drainage
Indian pipe <i>Monotropa uniflora</i>	2	low elevation redwood, mixed, and coniferous forests	Prairie Creek and Jedediah Smith Redwoods State Parks
Horned butterwort <i>Pinguicula vulgaris</i> ssp. <i>macroceras</i>	2	moist serpentine banks	known from Del Norte County
Great burnet <i>Sanguisorba officinalis</i> ssp. <i>microcephala</i>	2	bogs and streams, often on serpentine	unknown
Arctic starflower <i>Trientalis arctica</i>	2	bogs and other wet areas	known from near Crescent City
Langsdorf's Violet <i>Viola langsdorfii</i>	2	bogs among coastal dunes	near Crescent City
Marsh violet <i>Viola palustris</i>	2	wet shrubby places in coastal scrub below 500 feet in elevation	unknown
Howell's manzanita <i>Arctostaphylos hispidula</i>	4	rocky serpentine soils or sandstone, open sites, and forest	Little Bald Hills
Bolander's reed grass <i>Calamagrostis bolanderi</i>	4	bogs, moist meadows, open woodlands at low elevations	unknown
Leafy reed grass <i>Calamagrostis foliosa</i>	4	bluffs, cliffs, coastal scrub, and forest	unknown
Oregon bleeding heart <i>Dicentra formosa</i> ssp. <i>oregana</i>	4	damp shaded areas on serpentine soils	most likely to occur in Jedediah Smith Redwoods State Park

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SPECIES	STATUS	HABITAT	PARK LOCATION OR NEAREST KNOWN OCCURRENCE
PLANTS, continued			
Siskiyou daisy <i>Erigeron cervinus</i>	4	rocky open slopes, meadows, pine to fir woods above 2,500 feet in elevation	unknown
Tracy's tarplant <i>Hemizonia congesta</i> ssp. <i>tracyi</i>	4	grasslands and fallow fields in serpentine soils	Bald Hills
Howell's horkelia <i>Horkelia sericata</i>	4	dry rocky serpentine clay, open chaparral, or pine forest	most likely to occur in Jedediah Smith Redwoods State Park and Little Bald Hills
California globemallow <i>Iliamna latibracteata</i>	4	coniferous forests and streamsides	known from Humboldt and Del Norte Counties
Hair-leaved rush <i>Juncus supiniformis</i>	4	marshes, ponds, and ditches mostly below 300 feet in elevation	unknown
Del Norte pea <i>Lathyrus delnorticus</i>	4	streambanks and serpentine	Jedediah Smith Redwoods State Park
Bolander's lily <i>Lilium bolanderi</i>	4	chaparral, Douglas-fir, and knobcone pine	Jedediah Smith Redwoods State Park and Little Bald Hills
Vollmer's lily <i>Lilium pardalinum</i> ssp. <i>vollmeri</i>	4	coastal bogs, streams, and springs	unknown
Wiggins' lily <i>Lilium pardalinum</i> ssp. <i>wigginsii</i>	4	wet thickets, meadows, and streams among conifers	unknown
Purple-flowered Shasta lily <i>Lilium washingtonianum</i> ssp. <i>purpurascens</i>	4	Douglas-fir forest on serpentine soils	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
Heart-leaved twayblade <i>Listera cordata</i>	4	redwood and moist Douglas-fir forest	Jedediah Smith Redwoods State Park and Little Bald Hills
Howell's lomatium <i>Lomatium howellii</i>	4	serpentine, chaparral, and coniferous forest	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
Tracy's lomatium <i>Lomatium tracyi</i>	4	open pine forest, serpentine	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
Northern bugleweed <i>Lycopus uniflorus</i>	4	moist areas, marshes, and springs	unknown
Howell's sandwort <i>Minuartia howellii</i>	4	chaparral, Jeffrey pine/oak woodland, and serpentine	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
Nodding semaphore grass <i>Pleuropogon refractus</i>	4	wet meadows, shady banks in redwood and Douglas-fir forest	Prairie Creek and Del Norte Coast Redwoods State Parks
California pinefoot <i>Pityopus californicus</i>	4	redwood, mixed, or coniferous forest	Prairie Creek Redwoods State Park, Bald Hills, and near South Operations Center
Del Norte pyrrocoma <i>Pyrrocoma racemosa</i> var. <i>congesta</i>	4	chaparral, coniferous forest on serpentine soils	name suggests that it is most likely to occur in Jedediah Smith Redwoods State Park and Little Bald Hills
Del Norte willow <i>Salix delnorticus</i>	4	serpentine stream sides	known from near Gasquet

Appendix I: Rare, Sensitive, Threatened, and Endangered Species in Redwood National and State Parks

SPECIES	STATUS	HABITAT	PARK LOCATION OR NEAREST KNOWN OCCURRENCE
PLANTS, continued			
Peck's sanicle <i>Sanicula peckiana</i>	4	serpentine, chaparral, woodland	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
Glaucous tauschia <i>Tauschia glauca</i>	4	gravelly, often serpentine, flats in coniferous forests	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
Siskiyou inside-out flower <i>Vancouveria chrysantha</i>	4	dry sites, chaparral, coniferous forest on serpentine soils	most likely in Jedediah Smith Redwoods State Park and Little Bald Hills
AMPHIBIANS			
Del Norte salamander <i>Plethodon elongatus elongatus</i>	CSC	rock rubble and outcrops, road fill, and moss-covered talus in mature and old-growth coniferous forests	throughout parks in suitable habitat
Southern seep salamander <i>Rhyacotriton variegatus</i>	CSC	well-shaded seepages and streams in riparian, deciduous, and coniferous forests	throughout parks in suitable habitat
Tailed frog <i>Ascaphus truei</i>	CSC	streams in forests and grasslands	throughout parks in suitable habitat
Northern red-legged frog <i>Rana aurora aurora</i>	CSC	shaded streams and ponds in woodlands, forests, and grasslands	common throughout parks; coastal ponds near Enderts and Crescent Beaches are important breeding sites
Foothill yellow-legged frog <i>Rana boylei</i>	CSC	streams and rivers in woodlands, forests, and grasslands	throughout parks in suitable habitat
REPTILES			
Western pond turtle <i>Clemmys marmorata</i>	CSC	ponds and open water bodies	Prairie Creek and Del Norte Coast Redwoods State Parks; dead individual found at Redwood Creek estuary
BIRDS			
Common loon <i>Gavia immer</i>	CSC	coastal waters, lagoons, rivers, and streams	common winter visitor to parks
Double-crested cormorant <i>Phalacrocorax auritus</i>	CSC	coastal waters, rivers, and large streams	common resident; suspected breeder on offshore rocks
Osprey <i>Pandion haliaetus</i>	CSC	coastal waters, streams, and rivers, with snags and broken-topped trees	summer visitor; breeds in parks
Northern harrier <i>Circus cyaneus</i>	CSC	grasslands and open fields	resident; breeds in suitable habitat in parks
Sharp-shinned hawk <i>Accipiter striatus</i>	CSC	forests and open woodlands	resident; breeds in suitable habitat in parks
Cooper's hawk <i>Accipiter cooperi</i>	CSC	forests and open woodlands	resident; breeds in suitable habitat in parks
Golden eagle <i>Aquila chrysaetos</i>	CSC	open mountains and foothills	casual visitor over Bald Hills and open habitat in eastern part of Jedediah Smith Redwoods State Park

APPENDIXES

SPECIES	STATUS	HABITAT	PARK LOCATION OR NEAREST KNOWN OCCURRENCE
BIRDS, continued			
Merlin <i>Falco columbarius</i>	CSC	coastal areas, rivers, streams, brushy areas, and second-growth forests	winter visitor in suitable habitat in parks
Ruffed grouse <i>Bonansa umbellus</i>	CSC	deciduous forests	rare resident; breeds in suitable habitat in parks
California gull <i>Larus californicus</i>	CSC	coastal areas	primarily a winter visitor in parks
Burrowing owl <i>Athene cunicularia</i>	CSC	dunes and coastal grasslands	sporadic breeder in parks (nesting pair at Redwood Information Center in 1995)
Long-eared owl <i>Asio otus</i>	CSC	coastal grasslands and agricultural areas	a few winter records for northwestern California coast in Humboldt County; no park records
Short-eared owl <i>Asio flammeus</i>	CSC	dunes, coastal grasslands, and agricultural lands	casual winter visitor in parks
Vaux's swift	CSC	forests, woodlands, grasslands, fields, and towns	breeds in parks
Purple martin <i>Progne subis</i>	CSC	open areas and forests with nesting cavities	summer visitor; breeds in forests with snags that provide nesting cavities
Black-capped chickadee <i>Parus atricapillus</i>	CSC	riparian and deciduous forests	resident; breeds in parks
Yellow warbler <i>Dendroica petechia</i>	CSC	lowland riparian and deciduous woodlands, and coastal scrub	summer visitor; breeds in suitable habitat throughout parks
Yellow-breasted chat <i>Icteria virens</i>	CSC	lowland riparian and deciduous woodlands	summer visitor; breeds in suitable habitat throughout parks
MAMMALS			
Townsend's big-eared bat <i>Plecotus townsendii</i>	CSC	caves, mines, abandoned buildings, large hollow trees	no breeding colonies or hibernacula known; recorded from WWII radar site; probable in hollow redwoods as an accidental or transient
White-footed vole <i>Arborimus albipes</i>	CSC	dense red alder and willow forests	known from all three state parks; usually found in trees
Red tree vole <i>Arborimus longicaudus</i>	CSC	humid coastal Douglas fir forests	known from Prairie Creek Redwoods State Park; abundant suitable habitat throughout parks; strictly a tree-dwelling species in coastal, not inland, forests
Pacific fisher <i>Martes pennanti</i>	CSC	coniferous forests	known from suitable habitat throughout parks

DEFINITIONS AND KEY TO ABBREVIATIONS

PC = Prairie Creek Redwoods State Park
DNC = Del Norte Coast Redwoods State Park
JS = Jedediah Smith Redwoods State Park

COMMON = a species that is always or almost always encountered in proper season and habitat
UNCOMMON = a species that is present but not certain to be encountered in proper season and habitat
RARE = a species that is present but in very low numbers and is not likely to be encountered even in proper habitat

Appendix I: Rare, Sensitive, Threatened, and Endangered Species in Redwood National and State Parks

- CASUAL =** a species for which there are few records but is reasonably expected to occur again
- ACCIDENTAL =** a species that is out of its usual range and whose occurrence is unexpected and unpredictable
- RESIDENT =** a species that occurs in a given locality or habitat throughout the year in consistent numbers
- VISITOR =** a species that occurs in a given locality or habitat during a particular season
- T = THREATENED =** listed as threatened under the federal Endangered Species Act of 1973, as amended. The U.S. Fish and Wildlife Service defines threatened as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
- E = ENDANGERED =** listed as endangered under either the federal Endangered Species Act of 1973, as amended, or the California Endangered Species Act. The U.S. Fish and Wildlife Service defines endangered as any species that is in danger of extinction throughout all or a significant portion of its range
- P = PROPOSED =** Proposed for listing as threatened or endangered
- C = CANDIDATE =** Candidate species being reviewed by the U.S. Fish and Wildlife Service or National Marine Fisheries Service and under consideration for possible federal listing as threatened or endangered. Candidate species are those for which the U.S. Fish and Wildlife Service has enough information to propose listing
- F = FEDERAL =** U.S. Fish and Wildlife Service (50 CFR 17.11 and 17.12) or National Marine Fisheries Service (50 CFR Parts 222 and 227)
- CSC = SPECIES OF SPECIAL CONCERN =** Species about which the California Department of Fish and Game is concerned because of their limited numbers or because their breeding populations have declined in California so severely that they could become threatened or endangered
- S = STATE =** California Department of Fish and Game listing pursuant to Section 1904 (Native Plant Protection Act of 1977) and Section 2074.2 and 2075.5 (California Endangered Species Act of 1984) of the *California Fish and Game Code*
- 1B = CNPS LIST 1B =** Plants listed by California Native Plant Society as rare and endangered in California and elsewhere
- 2 = CNPS LIST 2 =** Plants listed by California Native Plant Society as rare or endangered in California but more common elsewhere
- 4 = CNPS LIST 4 =** Plants of limited distribution that should be watched for changes in population status or distribution, according to California Native Plant Society

APPENDIX J: SOUND LEVEL MEASUREMENT FOR DETERMINING IMPACTS ON THREATENED AND ENDANGERED SPECIES

Sound level measurements are established according to a logarithmic scale of decibels (dB). Separate measurements can be made for different sound frequency ranges, the most common being the "A-weighted" decibel scale (dBA) that approximates the way the human ear responds to noise levels. In this analysis, it is assumed that noise measured as dBA is comparable for noise effects on wildlife.

Noise descriptors commonly used in impact assessments are defined as follows:

L_{10} — the sound level exceeded 10% of the time for the period under consideration. This value is an indicator of both the magnitude (intensity) and the frequency of occurrence of the loudest noise events.

L_{eq} — the equivalent steady-state sound level that in a designated period of time (often 1 hour and expressed as $L_{eq(h)}$) would contain the same amount of sound energy as the varying levels of noise source during the same period.

L_{dn} — a 24-hour L_{eq} , with a 10 dB penalty applied to nighttime levels. This descriptor presents a day-night average noise level.

The L_{10} descriptor is easily understood. The L_{eq} descriptor is harder to understand but has advantages over L_{10} because it is more reliable for low-volume roadways, and noise levels can be added to one another for inclusion in noise analyses. The L_{eq} is typically about 3 dBA less than the L_{10} for the same conditions.

Sound levels described here in dBA are averages taken from federal guidelines for assessing noise for construction sites in developed areas; highways; and typical land uses such as residential areas, transient lodging, office buildings, retail commercial developments, livestock farming, other agriculture, and extensive natural wildlife and recreational areas. Sound levels in the parks are assumed to be equivalent to average measurements taken from guidelines.

Guidelines include the American National Standard Institute's *Sound Level Descriptors for Determination of Compatible Land Use* (1990; ANSI, S12 1240-1990). This descriptor indicates the noise level compatible for a particular land uses such as residential single-family dwellings, transient lodging developments, and natural areas.

A second noise standard, the "Federal Interagency Guidelines for Considering Noise in Land Use Planning and Control," was agreed to by the Department of Housing and Urban Development, the U.S. Department of Transportation, and U.S. Environmental Protection Agency, and the U.S. Department of Defense in 1980. These guidelines provide the basis for the ANSI noise guidelines.

Guidelines for assessing noise impacts due to traffic have also been established by the Federal Highway Administration and are contained in 23 CFR 772. These standards, known as Noise Abatement Criteria (NAC), identify design noise levels and relate them to various land uses or activities. NAC Category A includes areas where quiet is essential for enjoyment, such as nature sanctuaries. Category B includes noise-sensitive receptors like residences, motels, and outdoor recreation areas.

APPENDIX K: VISITOR USE STATISTICS

REDWOOD NATIONAL PARK

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
JAN	19,901	19,049	22,476	10,538	18,782	14,664	13,314	13,092	13,216	10,924
FEB	22,619	25,912	21,193	10,531	12,102	15,439	14,547	11,472	16,262	13,140
MAR	29,500	32,572	27,392	18,929	16,710	21,947	16,126	25,367	21,486	21,290
APR	33,984	40,070	34,238	24,846	22,418	31,689	25,881	24,370	32,603	27,396
MAY	56,127	56,461	56,041	27,130	29,871	36,478	34,384	38,339	54,728	36,107
JUN	75,396	83,479	91,340	42,462	34,520	49,382	51,792	54,722	69,710	58,363
JUL	112,990	130,356	124,402	65,704	60,921	63,634	73,388	79,816	92,704	69,776
AUG	112,178	117,022	110,454	60,429	71,255	61,426	73,614	78,205	132,599	76,032
SEP	69,296	81,795	75,835	42,700	43,719	39,614	58,197	61,623	59,038	49,650
OCT	32,894	45,673	40,281	21,439	28,862	25,215	33,034	46,576	38,450	36,729
NOV	22,205	21,375	26,493	13,714	13,338	15,203	18,866	25,306	15,519	15,237
DEC	23,807	23,371	23,970	10,036	13,782	13,090	7,884	16,145	6,149	12,294
TOTAL	610,897	677,135	654,115	348,458	366,280	387,781	421,027	475,033	552,464	426,938

An official visitor use survey conducted in 1987 and 1988 resulted in a change in the visitor counting procedure, which was implemented in 1990. This is why the visitation numbers in 1990 seem lower.

DEL NORTE COAST REDWOODS STATE PARK

	1987	1988	1989	1990	1991	1992	1993	1994
JAN	0	0	0	0	0	1,475	221	1,323
FEB	0	0	0	0	0	1,342	1,337	1,407
MAR	0	0	0	0	116	2,076	2,203	3,117
APR	944	0	0	0	2,463	2,346	2,752	2,609
MAY	5,902	3,297	3,393	0	4,150	5,049	4,994	5,398
JUN	13,666	8,310	11,216	9,142	8,344	9,840	10,346	11,087
JUL	26,378	27,139	20,480	21,623	18,923	19,817	23,499	25,216
AUG	25,364	25,878	19,775	20,751	19,001	22,028	23,453	22,418
SEP	11,826	3,896	2,498	9,196	7,534	6,856	8,174	23,886
OCT	2,435	0	0	3,831	3,326	2,759	3,206	3,221
NOV	0	0	0	1,885	1,981	1,066	1,707	1,544
DEC	0	0	0	0	1,839	368	1,598	1,155
TOTAL	86,515	68,520	57,362	66,428	67,677	75,022	83,490	102,381

Note: Visitation of "0" is because the park was closed during these months.

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JEDEDIAH SMITH REDWOODS STATE PARK

	1987	1988	1989	1990	1991	1992	1993	1994
JAN	8,459	9,094	11,493	9,365	2,568	6,516	8,081	9,085
FEB	6,216	7,007	6,893	8,589	3,492	6,832	8,423	4,655
MAR	8,685	6,330	12,872	9,642	5,455	11,512	6,935	6,475
APR	12,629	6,464	11,727	19,178	9,421	9,833	6,851	10,710
MAY	15,819	11,578	15,745	8,821	6,408	13,705	9,892	17,829
JUN	19,483	14,252	15,875	17,360	17,299	12,206	20,123	29,608
JUL	23,587	24,210	24,274	25,319	19,317	25,956	33,489	43,322
AUG	23,705	24,058	23,574	24,691	18,455	25,832	36,266	36,554
SEP	26,601	24,356	14,266	12,801	11,073	9,623	28,726	20,329
OCT	12,672	12,921	16,199	7,921	6,836	9,917	13,595	12,335
NOV	8,089	11,517	11,563	5,261	7,398	4,538	4,325	2,952
DEC	7,703	3,425	6,419	2,144	5,125	4,922	5,765	1,666
TOTAL	173,648	155,212	170,900	151,092	112,847	141,392	182,471	195,520

PRAIRIE CREEK REDWOODS STATE PARK

	1987	1988	1989	1990	1991	1992	1993	1994
JAN	26,747	19,919	34,090	30,124	24,857	25,053	24,064	34,138
FEB	25,905	31,577	21,420	25,424	26,844	26,022	22,269	25,797
MAR	44,577	40,198	33,002	43,333	28,659	30,255	32,657	38,085
APR	52,442	48,186	38,867	48,415	33,099	34,628	36,423	36,112
MAY	62,258	60,235	59,371	53,142	43,452	46,254	41,268	41,096
JUN	72,349	66,082	67,265	49,107	57,377	45,785	53,958	48,310
JUL	93,749	105,164	90,603	67,765	102,211	58,738	85,914	43,790
AUG	115,819	100,751	88,125	68,234	107,922	63,965	93,285	39,830
SEP	66,825	94,152	64,280	55,097	70,687	58,465	55,407	62,867
OCT	47,082	55,159	43,452	47,683	43,552	30,216	43,048	40,887
NOV	25,368	34,519	41,237	34,038	27,064	29,700	37,559	12,978
DEC	16,327	27,119	33,845	27,860	27,186	19,518	33,905	16,202
TOTAL	649,448	683,061	615,557	550,227	592,910	468,599	559,757	440,092

APPENDIX L: ACREAGES OF EXISTING AND PROPOSED RNSP FACILITIES AND DEVELOPMENT WITHIN POTENTIAL HABITAT FOR THREATENED AND ENDANGERED BIRDS

TABLE L-1. SPECIFIC ACREAGES OF RNSP FACILITIES AND DEVELOPMENT WITH POTENTIAL HABITAT FOR THREATENED AND ENDANGERED BIRDS

NOTE: The following are site-specific acreages of RNSP facilities and development, excluding roads and trails, within potential habitat for peregrine falcons, bald eagles, brown pelicans, snowy plovers, northern spotted owls, or marbled murrelets. Park developed areas and facilities are listed from north to south.

AREA/FACILITY	ACREAGE	AREA/FACILITY	ACREAGE
Camp Lincoln	3.74	Elk Prairie campground/picnic area	47.45
Templeman Meadow/picnic/camp	54.29	Gold Bluffs environmental camp	0.53
Hanson Property	0.72	Wolf Creek Education Center/picnic area	3.84
Jedediah Smith Redwoods State Park campground/picnic area	168.99	Wolf Creek fire cache	0.62
Little Bald Hills parking area	0.12	Little Lost Man Creek parking/picnic area	0.14
Little Bald Hills primitive camp	1.54	Davison Ranch (B-Mill Deck) trailhead/parking /picnic area	8.43
Aubell Ranch	18.27	Lady Bird Johnson trailhead/parking/picnic area	0.24
Howland Hill Outdoor School	5.64	Redwood Creek trailhead/picnic area	0.53
Crescent Beach picnic area	0.60	Redwood Information Center/ Freshwater Lagoon Spit/Redwood Creek picnic area	67.38
Mill Creek campground/ residence/ picnic area	62.11	South Operations Center field	2.93
Nickel Creek primitive camp	0.17	South Operations Center picnic area	4.90
DeMartin primitive camp	0.26	South Operations Center residence	0.21
False Klamath Cove overlook	0.71	Elam Creek horse camp	3.03
Redwood Youth Hostel	2.24	Tall Trees parking	0.38
Wilson Creek view-point/picnic area	0.39	Elk Camp barn	0.10
Lagoon Creek picnic area	2.68	44 Creek horse camp	0.21
Requa administrative area and Klamath River overlook	80.62	Tall Trees trailhead /picnic area	0.18
Flint Ridge primitive camp	8.17	Dolason Barn	0.06
Marshall Pond	2.79	Schoolhouse Peak	15.08

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AREA/FACILITY	ACREAGE	AREA/FACILITY	ACREAGE
High Bluff overlook/picnic area	9.85	Lyons Ranch parking	0.18
Butler Creek primitive camp	0.32	Long Ridge barn	0.04
Fern Canyon Trailhead/ picnic area	0.77	Lyons Ranch Homeplace	0.08
Miner's Ridge primitive camp	0.81	Coyote Creek barn	0.04
Gold Bluffs Beach campground/picnic area	9.12	Coyote Creek line cabin	0.02
Big Tree Wayside	0.66	Dooleyville line shack	0.01

APPENDIX M: GIS METHODS FOR DETERMINING OLD-GROWTH FOREST HABITAT FOR NORTHERN SPOTTED OWLS AND MARBLED MURRELETS

Acreages of endangered species habitat, including old-growth forest, second-growth forest lands, and lands with characteristics suitable for northern spotted owl and marbled murrelet nesting, were calculated using computer-based geographic information system (GIS) technology. In GIS terminology, a theme is a combination of characteristics or features that are geographically referenced to a point on the surface of the earth. The procedure of identifying a set of features as belonging to a group is termed classification. Several classifications may be combined into a theme. Different themes are sometimes referred to by a convenient title such as "old growth," but each theme may have been developed using different criteria.

GIS classifications of vegetation are sometimes very different even though the classification has the same title because the computer users who created a theme needed different information than another user. A wildlife biologist interested in habitat suitable for northern spotted owls has a different perspective than a vegetation manager interested in restoring second-growth forests to conditions found in old-growth forest. The relative spatial scale at which vegetation is classified also results in different classifications of a single point in space.

Thus, an "old-growth" theme was defined by different resource specialists in the parks in three ways: (1) the absence of cutting in coniferous forest stands; (2) defined as uncut on other vegetation themes and therefore defined as old-growth by a process of exclusion; or (3) visible on orthophotographs as not having been logged. (Orthophotographs are satellite photographs that have been corrected for geographic distortions caused by earth rotation and curvature, satellite motion, attitude, viewing perspective, and relief displacement.)

The type of vegetation in RNSP forest stands was classified based on 1:12,000 enlarged and 1:24,000

rectified orthophotographs; 1:100,000 unrectified NASA U-2 orthophotos; SPOT imagery from satellite photography; and visual review of aerial photographs at several different scales. Some field work was done to check the reliability of classification based on aerial photography. The year a stand was last logged was obtained from timber company records or comparison of aerial photographs taken at different times.

The year a stand was last logged was used to develop a theme called "cut history." Because the 1:6,000 aerial photography on which cut history was based covered only the Prairie Creek and lower Redwood Creek basins in the southern part of the parks, different themes were developed to integrate vegetation parkwide with cut history. The cut history theme classifies areas logged before 1950; the last logging cycle in 1976-78; and five 4-5 year intervals from 1950 through 1975.

Some coniferous forest stands were clearcut, and no large trees were left standing. Large old trees remained after logging in other forest stands. The "residual old-growth" theme measures the relative amount of residual large trees and canopy cover that meet the criteria of suitable nesting habitat for northern spotted owls or marbled murrelets, as determined by the parks' wildlife biologists. "Residual old-growth" ranges from small stands of 5 to 10 trees together to single trees left as part of the seed-tree restocking harvest method and scattered over a cut block. Five categories of "old-growth" are included in the final theme used to determine suitable old-growth nesting habitat for murrelets and spotted owls: old-growth coniferous forest; coniferous forest with greater than 50% of the original stand remaining; coniferous forest with 20% to 50% of the original stand remaining; coniferous forest with 20% or less of the original stand remaining; and no large trees remaining.

GLOSSARY

ACTIVITY CENTER: As used in reference to northern spotted owls, an area of concentrated activity of either a pair of owls or a single territorial owl.

ADAPTIVE USE: Use for a building, structure, or landscape other than its historic use, normally involving some modification of the building, structure, or landscape.

ADVISORY COUNCIL ON HISTORIC PRESERVATION: An independent federal agency with statutory authority to: review and comment on federal actions affecting properties listed in or eligible for listing on the National Register of Historic Places; advise the president and Congress on historic preservation matters; and recommend measures to coordinate activities of federal, state, and local agencies. Its members include Cabinet-level representatives from federal agencies and presidential appointees from outside the federal government.

AFFECTED ENVIRONMENT: The existing biological, physical, social, and economic conditions of an area that are subject to change, both directly and indirectly, as a result of a proposed human action.

AGGRADATION: The building up of the earth's surface by deposition, such as the raising of a streambed by deposition of sediment to establish or maintain uniformity of grade or slope.

ARCHEOLOGICAL RESOURCES: Any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. Such resources are capable of revealing scientific or humanistic information through archeological research.

ARCHEOLOGY: The scientific study, interpretation, and reconstruction of past human cultures based on the investigation of the surviving physical evidence of human activity and the reconstruction of related past environments. An archeologist is a scientist who is professionally trained to conduct such studies.

ARCHIVES: The past records of an organization or institution preserved for their historic value. The term archives is often used to refer to the repository where archives and other historic documents are maintained.

BENEFICIAL USES: Beneficial uses of the waters of the state of California that may be protected against water quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.

CANOPY: A layer of foliage in a forest stand. This often refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multistoried stand.

CANOPY CLOSURE: The degree to which the canopy blocks sunlight or obscures the sky.

CARRYING CAPACITY: The type and level of visitor use that can be accommodated while sustaining desired resource and social conditions that complement the purposes of the parks and their management strategies. Carrying capacity is affected by both physical constraints and the more subjective perceptions of what constitutes a high-quality recreation experience.

CLEARCUT: A harvest in which all or almost all of the trees are removed in one cutting.

COMPLETE ROAD REMOVAL: See **LANDFORM RESTORATION**

CONSERVATION EASEMENT: Legal agreement that property owners enter into to restrict certain uses of the land. It legally binds all current and future owners of the land to the specified restrictions, thus providing permanent or long-term protection. An easement may have a specified time period or may last in perpetuity. Conservation easements may be tailored to protect specific attributes of all or part of a piece of property such as protection of natural undeveloped conditions, scenic qualities, or wetlands.

CORRELATIVE WATER RIGHTS: The rule of correlative rights holds that the right to make an overlying use of water is not absolute but is relative to the rights of other overlying users. The rule is used primarily when the groundwater supply is insufficient to satisfy the needs of all overlying users. In such a case, the correlative rights rule requires sharing. In some cases, sharing is accomplished by prorating the supply on the basis of overlying

acreage, although the recent trend suggests a more flexible approach.

CORVID: A family of birds that includes ravens, crows, and jays.

CRITICAL HABITAT : As defined in 50 CFR section 402.2,

the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection, or specific areas outside the geographical area, occupied by the species at the time of listing, that the Secretary of the Interior determines are essential for the conservation of the species.

CULTURAL LANDSCAPE: A geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values.

CULTURAL RESOURCE: An aspect of a cultural system that is valued by or significantly representative of a culture or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources for RNSP management purposes.

CUMULATIVE IMPACTS: Those effects on the environment that result from the incremental effect of the action when added to the past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

CUT BLOCK: A stand or unit of trees that was harvested, usually clearcut, at the same time.

CUTOVER LAND: Land that has borne a crop of commercial timber from which at least 70% of the merchantable original-growth timber stand has been removed by logging. The term is used interchangeably with second-growth forest.

DEBRIS AVALANCHE: A mass of rock fragments, soil, and organic debris with a high water content that has moved extremely rapidly downhill.

DEBRIS SLIDE: A landslide involving a slow-to-rapid downslope movement of relatively dry unconsolidated earth, soil, and organic debris in which the mass does not show backward rotation as in a slump, but slides or rolls forward forming an irregular hummocky deposit.

DEGRADATION: The wearing down and general lowering of the Earth's surface by the natural processes of weathering and erosion, such as the vertical downcutting performed by a stream to establish or maintain uniformity of grade or slope.

DIRECT EMPLOYMENT AND EARNINGS: NPS or CDFR jobs taken by workers (and their earnings) in response to joint-plan-related changes, e.g., the need for more maintenance workers, backcountry rangers, interpretive rangers, etc. Also included in this category are jobs taken by workers (and their related earnings) at local hotels, restaurants, gas stations, etc. because of the increase in demand at such establishments because of increased visitation at Redwood National and State Parks.

DISCOVERY SITE: Cultural resource sites where visitation is not actively encourage and there is minimal or no onsite interpretation.

DISTURBED LANDS RESTORATION: See : LANDFORM RESTORATION

DIVERSION POTENTIAL: A condition at a stream crossing where, if the drainage structure (culvert or Humboldt crossing) plugs and overflows, the flow could go out of the natural drainage and down the road or inboard ditch and cause gullying, mass wasting, erosion, or road failure.

EASEMENT: A right afforded a property owner to make limited use of another property owner's real property.

GLOSSARY

ECOSYSTEM: A community of living organisms interacting with one another and with their physical environment.

EL NIÑO: An ocean-atmosphere interaction that includes warm ocean currents rising off South America's west coast and a stronger than normal Pacific subtropical jet stream, with a very active storm track along its path.

ENVIRONMENTALLY SENSITIVE HABITAT AREA AND ENVIRONMENTALLY SENSITIVE AREA: Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments (defined in sections 30240 and 30107.5 of California Coastal Act).

EROSION CONTROL: See **EROSION PREVENTION**

EROSION PREVENTION, also called **EROSION CONTROL:** A systematic, ongoing program that improves and maintains the condition of roads to prevent erosion and sediment impacts on various natural resources. Erosion prevention is applied to roads that cannot be permanently closed because they are needed for current and future land management purposes. Where a road crosses a stream, some road-bed fill is excavated. The stream crossing fill is shaped to form a broad, permanent low point that is driveable by standard logging vehicles at reduced speeds. This broad low point (rolling dip) prevents a stream from diverting down the road should culverts plug with debris or be overwhelmed by torrents of water during major storms. Culverts at stream crossings are replaced if they are worn or undersized. Between stream crossings, road surfaces are drained by frequent rolling dips. Where inside road ditches can be eliminated, road surfaces are reshaped to provide a moderately, outward sloping surface that drains road surface runoff. Unstable fill is pulled back to prevent landslide erosion that could reach a stream channel or other critical areas. Erosion prevention requires ongoing road maintenance.

ESTUARY: Water at the mouths of streams that are usually semi-enclosed by land but has open, partly obstructed, or sporadic access to the open ocean. Estuaries serve as mixing zones for freshwater and seawater; and generally extend from the upstream limit of tidal action to a bay or open ocean.

ETHNOGRAPHIC RESOURCES: A site, structure, object, landscape, or natural resource feature assigned legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

EXOTIC SPECIES: Species not native to the area.

FAULT: A fracture or rupture along which there has been displacement of adjacent earth materials. Movements along faults produce earthquakes.

FAILURE: See road failure.

FEE OWNERSHIP: A category of landownership in which one person or agency owns all the rights associated with a parcel of land, in contrast to less-than-fee ownership.

FILL: Earthen material deposited in a depression to make a level surface or used to construct a level road surface or that is excavated in the course of road removal or treatment.

FINDING AID: A textual or electronic tool that assists researchers in locating or using archival and manuscript collections.

FLOOD EASEMENT: Legal agreement that property owners enter into that grants the perpetual right, power, or privilege to overflow, flood or submerge lands. The landowner is reserved all rights and privileges that do not interfere with or abridge this right. The easement may be permanent or occasional.

FLOODPLAIN: Land adjacent to a river or stream that is periodically subject to flooding.

FOREST FRAGMENTATION: The creation of habitat islands through land development, land use, or natural causes such as large wildfires.

FTE: Full-time equivalent is a way of combining part-time positions into numbers that can be compared to full-time employees. For example, four part time employees who each work for three months of the year are equivalent to one full-time, year-round employee.

HILLSLOPE FAILURE: Rapid movement or collapse of a hillslope due to the loss of its structural cohesiveness on logged lands. Failure commonly occurs through the loss of vegetation and saturation of soils

with water. Generic term that includes landslides, debris flows and slides, avalanches, etc.

HISTORIC DISTRICT: A geographically definable area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, landscapes, structures, or objects, united by past events or aesthetically by plan or physical developments. A district may also be composed of individual elements separated geographically but linked by association or history.

HISTORIC SITE: The site of a significant event, prehistoric or historic occupation or activity, or structure or landscape whether extant or vanished, where the site itself possesses historical, cultural, or archeological value apart from the value of any existing structure or landscape.

INDIRECT EMPLOYMENT AND EARNINGS: Jobs and related earnings of workers hired to produce goods and services needed to support expanded RNSP operations as a result of implementing the approved management plan for the parks, including contracted services, paper products, computers and other equipment, vehicles, and jobs and related earnings of workers hired to provide goods and services to establishments that provide tourism-related services (e.g., hotels and restaurants, etc.) to RNSP visitors.

INDUCED EMPLOYMENT AND EARNINGS: Jobs and related earnings of workers hired to produce goods and services needed by direct and indirect workers as a consequence of the respending of direct and indirect earnings in the local economy. Basically, this is the economic effect of household expenditures made by direct and indirect workers. Thus, when new RNSP employees earn money, they spend a portion of it in the local economy and others are hired to provide the goods and services they demand.

INSTANTANEOUS DISCHARGE: The volume of water passing a given channel cross section during a specified time interval, usually measured in cubic feet per second or cubic meters per second.

INTEGRITY: The authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during its historic or prehistoric period; the extent to which a property retains its historic appearance.

INTERMITTENT STREAM: Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition.

LAGOON: Lagoons are the drowned mouths of stream valleys that are separated from the ocean by wave-built sand spits.

LANDFORM RESTORATION, also called COMPLETE ROAD REMOVAL OR DISTURBED LANDS RESTORATION: A process that reshapes and recontours landforms after roads have been completely removed. In Redwood National and State Parks, landform restoration includes excavating road fill from stream channels, pulling back side-cast road fill, decompacting roads, retrieving and burying debris from logging and other activities (cable, abandoned vehicles, concrete foundations, etc.), restoring the original configuration of the land (ridges, stream valleys and swales) along the road corridor to the end of the road, and spreading the topsoil, forest duff, and organic matter encountered during excavations on the finished surfaces. Besides reestablishing the natural appearance and function of hillslope drainage patterns, this treatment also ensures all road sections capable of landslide erosion are treated. This is particularly important on roads that cross steep, potentially unstable hillsides, especially if organic debris was buried in the road fill during road construction because rotting organic debris increases the likelihood of landslides. Landform restoration as accomplished in the RNSP watershed restoration program may be either partial or complete. In **partial landform restoration**, all major logging roads and a limited number of minor roads are completely removed, and these areas are reshaped and recontoured. Some individual minor roads, or portions of roads that are not completely removed, remain and are decommissioned under the partial landform restoration approach. In the **complete landform restoration** approach, all major and minor logging roads are completely removed and the areas are reshaped and recontoured.

LESS-THAN-FEE OWNERSHIP: A category of land-ownership in which one party owns one or more, but not all, of several separate rights to a property, in contrast to fee ownership. For example, the mineral or timber rights may have a different owner than the land itself.

LEVEE: A dike or embankment of earth or concrete used to prevent water from overflowing the river channel during times of flooding.

GLOSSARY

LEVEE RESTRUCTURING: Removal or modification of the configuration of a levee. In this document, levee restructuring refers to removal or modification of the lower portion of the federal flood control levees along Redwood Creek for the purpose of restoring estuary fish and wildlife habitat and biological and physical processes in the Redwood Creek valley and estuary.

LIFELINES: Facilities such as highways, bridges, tunnels, major airports, electrical power lines, communication lines, water supply lines, marine terminals, and railroads.

LIQUEFACTION: A temporary change of solid ground into a fluid form, due to the shock from an earthquake.

LITTORAL: A coastal region, especially the shore zone between high and low watermarks.

MAGNITUDE: The total energy released by an earthquake. Magnitudes in this document are measured on a *moment magnitude* scale, the standard scale now used by seismologists. It accurately measures earthquake strength directly related to seismic energy release, and unlike the Richter scale, is accurate even for large-scale earthquakes.

MASS WASTING: The movement of rock and soil that is controlled directly by gravity and includes gradual movements such as creep and solifluction and rapid movements such as rockfalls, landslides, debris avalanches, and slides and mudflows. Mass wasting excludes stream erosion.

MINOR ROAD IMPROVEMENTS: those improvements that are required to ensure safe and adequate automobile and pedestrian circulation and resource protection. These improvements are usually specific to a certain areas of the road and completed as part of a program that extends over longer periods of time. Such improvements would be for visitor safety and improved automobile circulation, not for drastically increasing the traffic capacity on the road. Examples of minor road improvements include creating turn-outs, widening a specific area, straightening hazardous curves, improving intersection sight lines, and controlling erosion and dust.

MORPHOLOGY: Refers to the physical structure and form such as a body of water, e.g., pools, riffles, runs, gravel bars, and other physical features.

MOTOR VEHICLE: As defined in 36 CFR 1.4, a motor vehicle means every vehicle that is self-propelled and every vehicle that is propelled by electric power, but not operated on rails or upon water, except snowmobiles and a motorized wheelchair. A motorized wheelchair means a self-propelled wheeled device, designed solely for and used by a mobility impaired person for locomotion, that is both capable of and suitable for use in indoor pedestrian areas.

NATIONAL REGISTER OF HISTORIC PLACES: The comprehensive list of districts, sites, buildings, structures, and objects of national, regional, state, and local significance in American history, architecture, archeology, engineering, and culture kept by the National Park Service under authority of the National Historic Preservation Act of 1966.

NONPOINT: A source of sediment or pollution (such as runoff from a field) that cannot be linked to a discrete, identifiable source.

OCCUPIED BEHAVIOR: As used in this document, one of several behavior patterns of marbled murrelets. Typically, the behavior includes adult birds flying below, through, into, or out of the forest canopy; circling above the canopy in a small or large radius; perching, landing, or attempting to land on branches; or calling from a stationary location within a forest stand. These behaviors are used as an indication that a forest stand is used for breeding activity when direct observation of these small birds or nests located high in a dense forest canopy is difficult.

OLD-GROWTH FOREST: An older forest that differs significantly from younger forests in structure, ecological function, and species composition. Typically, these forests are stands that are at least 180 to 220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground.

PARTIAL LANDFORM RESTORATION: See Landform Restoration

POTENTIAL HABITAT: As used in this document, a stand of trees of a vegetation type used by northern spotted owls or marbled murrelets that is not currently suitable but is capable of growing or

developing into suitable habitat in the future. In general, potential habitat are stands in earlier successional stages of forest types used by spotted owls or marbled murrelets.

PRESCRIBED FIRE: The intentional application of fire to accomplish specific planned management strategies.

PRESCRIPTION: As used in fire management, measurable criteria that guide the selection of appropriate management strategies and actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social or legal considerations.

PRESERVATION: The act or process of applying measures to sustain the existing form, integrity, and material of a historic structure, landscape, or object. Work may include preliminary measures to protect and stabilize the property, but generally focuses upon the ongoing preservation maintenance and repair of historic materials and features rather than extensive replacement and new work.

PROTECTION: An action to safeguard a historic property by defending or guarding it from further deterioration, loss, or attack or shielding it from danger or injury. In the case of structures and landscapes, such action is generally of a temporary nature and anticipates future preservation treatment; in the case of archeological sites, the protective measure may be temporary or permanent. Protection in its broadest sense also includes long-term efforts to deter or prevent vandalism, theft, arson, and other criminal acts against cultural resources.

REARING HABITAT: As used in this document, areas in rivers, streams, or estuaries where juvenile salmon or trout find food and shelter to live and grow.

RECURRENCE INTERVAL: The average time span between earthquakes at a particular site.

REHABILITATION: The act or process of making possible an efficient compatible use for a historic structure or landscape through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, and architectural values.

RESIDUAL STAND: The trees that remain standing after some event such as selection cutting.

RIPARIAN: Typically refers to vegetation found along waterways and shorelines that is adapted to moist growing conditions and occasional flooding. Riparian vegetation helps stabilize the streambanks, provides cover and food for fish, and intercepts solar radiation.

RIPARIAN AREA: Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. The term is normally used to refer to the zone within which plants grow rooted in the water table of rivers, streams, ponds, lakes, reservoirs, springs, marshes, seeps, bogs, or wet meadows.

ROAD INVENTORY: A systematic field evaluation of roads that assesses and quantifies the potential for erosion along roads.

ROAD DECOMMISSIONING: This action reduces the potential for erosion at stream crossings and unstable road segments.

Road sections without landslide potential do not receive extensive treatments. Instead, the road surface is decompacted to promote revegetation and permanent surface drainage is provided. Natural drainage patterns along these roads are reestablished by a minor reshaping of a road section or by improving drainage off the road through the construction of deep surface drains (ditches) excavated through the road prism. Because road decommissioning does not completely reshape and recontour all road sections between stream crossings, this treatment would decrease the potential for erosion and sedimentation from more roads faster than landform restoration methods. However, there is a possibility that sites with landslide potentials may not be recognized during road inventories and other field evaluations before treatment, and that sections could fail after treatment is completed.

ROAD FAILURE / ROAD FILL FAILURE: A general term used to indicate that erosion has damaged a section of a road. Where there are oversteepened road cuts and roads crossing stream courses, and in areas where fill has been used to construct the roads, the materials may erode and be transported downslope. Damage to the roads is normally caused by running water at stream crossings and on slopes adjacent to the roads.

GLOSSARY

RUN-UP: The distance that water advances onto a beach or shoreline following the breaking of an ocean wave.

SCOUR AND FILL: The alternate excavation and refilling of a river channel. Scour and fill occurs during a flood or series of floods when the volume and velocity of an aggrading stream are suddenly increased causing the formation of new channels that become filled with sediment when the flood subsides.

SECOND-GROWTH FOREST: A relatively young forest that has developed after a disturbance (e.g., wholesale cutting, serious fire, or insect attack) of the previous old-growth. Second-growth forest is used to refer to cutover lands, regardless of how many times the stand was logged.

SELECTION CUTTING: A method of uneven-aged management involving the harvesting of single trees from stands (*single-tree selection*) or groups of trees (*group selection*) without harvesting the entire stand at any one time.

SENSITIVE RESOURCES: Sensitive resources are resources that are specifically protected by law, regulation, guideline, policy, or executive order; or resources that are easily damaged by use; or resources that are rare or unique in the parks and the region. The most common examples of sensitive resources or sensitive areas in the parks are the old-growth redwoods, the wetlands, the prairies, threatened and endangered species and their habitat, and cultural resources including archeological sites, ethnographic sites, and sites that are of importance to American Indians.

SERAL STAGE: One of a series of stages of vegetation that follows in succession.

SIDE-CAST FILLS: Materials such as soil, rock, and organic debris that have been excavated during the construction of logging roads and have been either discarded along the hillslopes and sides of the roads or used to construct the outboard edge of the road.

SUBSISTENCE: The traditional use of natural plants and wild animals for personal or family consumption — such as making and selling handicraft articles out of the nonedible byproducts of fish and wildlife resources that were taken for personal or family use or consumption and for customary trade. The legislation for some parks defines what constitutes subsistence there.

STATE HISTORIC PRESERVATION OFFICER (SHPO): An official within each state appointed by the governor to administer the state historic preservation program and carry out certain responsibilities relating to federal undertakings within the state.

SILVICULTURAL PRESCRIPTION: A plan for controlling the establishment, composition, constitution, and growth of forests.

SITE-POTENTIAL TREE HEIGHT: The average, maximum height of the tallest dominant trees (200 years or older) for a given habitat type and location.

SLOUGH: A stagnant swamp, marsh, bog, or pond that is part of an inlet or backwater.

SNAG: A standing dead tree or standing dead section of a tree.

STAND: A community of trees or other vegetation sufficiently uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities and so form a silvicultural or management entity.

STAND NATURALIZATION: The process of removing unwanted sizes and species of trees that were planted or seeded on a site after commercial logging.

SUCCESSIONAL FORESTS: Stages of a forest that evolve from bare ground to a climax community.

SUSTAINABILITY: Sustainability could be defined as the capability of natural and cultural systems to maintain themselves over time. Examples would include the Redwood Creek watershed ecosystem that is restored to the point that all components and processes of the watershed can sustain themselves indefinitely, changing only according to natural succession and processes. Components would include such things as large redwood trees along the main channel of Redwood Creek, historically and prehistorically occurring fish species in Redwood Creek and its tributaries, and marbled murrelets and spotted owls in the watershed forest, all with healthy reproducing populations and historical and prehistorical numbers.

Sustainably designed facilities might include buildings made of recycled materials that require minimum energy and no toxic materials to produce and that are themselves nontoxic to living systems. These materials would also be very long lasting and

would perform very well. The buildings would function with a minimum amount of energy. Management actions consistent with sustainability would minimize impacts on natural and cultural systems over the long term.

STREAM CROSSING: Where a road crosses a flow course. The crossing may be composed of road fill without a drainage structure or may be composed of buried logs (Humboldt crossing), a culvert, or a bridge.

SUPPRESSION: A management action intended to protect identified values from a fire, extinguish a fire, or alter a fire's direction of spread.

TECTONICS: A branch of geology concerned with the structure of the crust of a planet (as earth) or moon.

THINNING: A silvicultural practice in which trees in immature stands are selectively harvested to improve the quality and growth of the remaining trees.

TRADITIONAL RESOURCE USE: A subsistence or other consumptive use usually but not always based on customary low-energy technology. Ceremonial uses, involving particular places and plant and animal materials, may be private and individualized or restricted to designated groups. Use can be onsite and visible, inferred from effects, or offsite and referenced in traditional narratives.

TSUNAMI: An impulsively generated seawave of local or distant origin that results from large-scale sea floor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.

UNDERSTORY: Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

VIEWSHED: A total landscape seen or potentially seen from specific points on a specific part of a travel route or water body.

VISUAL RESOURCES: The composite of basic physiographic features and patterns and land use effects that typify a land unit and influence the visual appeal the unit may have to visitors.

WATERSHED: The area drained by a river system.

WATERSHED RESTORATION: A scientifically based program that restores biological and physical elements of the watershed to improve its health. It greatly improves the elements of a watershed that have been impacted by past and current land management practices. Watershed elements are multidisciplinary and include biological and earth/physical resources. Improvements to these elements occur from the farthest reaches of headwater streams, throughout a watershed's tributaries, to the estuary and to the sea. Reducing accelerated rates of erosion and sedimentation from roads is only one element of watershed restoration. Sediment reduction occurs by various methods, including landform restoration, road decommissioning, and erosion prevention.

WETLAND: Areas that are inundated by surface or groundwater with a frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth or reproduction. Wetlands include swamps, marshes, bogs, wet meadows, river overflows, mud flats, sandy ocean shorelines, and natural ponds, among other types.

WILDFIRE: Any wildland fire that is not a prescribed fire.

WILDLAND FIRE USE: A fire management program in which natural ignitions are not suppressed under specific prescriptions to achieve preestablished resource management objectives.

BIBLIOGRAPHY

- Adams, J.
1984 "Active Deformation of the Pacific Northwest Continental Margin." *Tectonics*. 3:449-472.
- Alexander E., W. Colwell, J. DeLapp, E. Gladish, R. Nelson, R. Skolmen, and B. Smith
1952-78 *Humboldt-Del Norte County, California Soil-vegetation Surveys*. California Department of Forestry. Redding, CA 75 maps, 1:31680 scales, and legends
- Aronoff, S.
1989 *Geographic Information Systems: A Management Perspective*. WDL Publications. Ottawa, Canada.
- Arthur D. Little, Inc.
1966 *The Impact of the Proposed Redwood National Park on the Economy of Del Norte County*. San Francisco, CA.
1967 *The Economic Impact of Possible Additions to a Redwood National Park in Humboldt County: A Report to the National Park Service*. San Francisco, CA.
- Atwater, B.F.
1987 "Evidence for Great Holocene Earthquakes Along the Outer Coast of Washington State." *Science*. 236:942-944.
- Barbour, M. G., and W. D. Billings, eds.
1988 *North American Terrestrial Vegetation*. New York, New York: Cambridge University Press.
- Becking, R. W.
1967 "The Ecology of the Coastal Redwood Forest and the Impact of the 1964 Floods upon Redwood Vegetation: Final Report." National Science Foundation Grant No. 3468. Arcata, California. Copy available at RNSP offices in Arcata, CA.
- Beissinger, S. R.
1995 "Population Trends of the Marbled Murrelet Projected from Demographic Analyses." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 385-93. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Berg, L.
1982 "The Effect of Exposure to Short-term Pulses of Suspended Sediment on the Behavior of Juvenile Salmonids," pp. 177-196 in G. F. Hartman, et al., editors. *Proceedings of the Carnation Creek Workshop: A Ten Year Review*. Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, British Columbia, Canada.
- Black, P. E.
1967 "The Coast Redwoods, Water, and Watersheds." Mimeographed report. N.p. Copy available at Redwood National Park files, Arcata, CA.
- Bolt, Beranek, and Newman
1971 *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. Report NTID300.1 for the U.S. EPA Office of Noise Abatement and Control, Washington, D.C.
- Boyd, M. J. and J. D. DeMartini
1977 "The Intertidal and Subtidal Biota of Redwood National Park." Prepared for the National Park Service. Contract CX8480-4-0665. Copies available at RNSP offices, Arcata and Orick.
- Brown, P. M., and T. W. Swetnam
1994 "A Cross-dated Fire History from Coast Redwood near Redwood National Park, California." *Canadian Journal of Forest Resources* 24:21-31.

- Brusca, G. J., and R. C. Brusca
[1971] *A Naturalist's Seashore Guide — Common Marine Life of the Northern California Coast and Adjacent Shores.* Eureka, CA.
- Bureau of Economic Analysis, U. S. Department of Commerce
1996 Personal Income by Major Source and by Industries, (computer output) Table CA05, June 1996. Washington, D.C. Available on Internet.
- 1996 REIS, (computer output) Table SA25, June 1996. Washington, D.C. Available on Internet.
- Bureau of Land Management, U. S. Department of the Interior
1989 *Proposed Arcata Resource Management Plan and Final Environmental Impact Statement.* Ukiah, CA.
- 1995 *Arcata Planning Area Proposed Resource Management Plan Amendment and Environmental Assessment.* Arcata, CA.
- Bureau of the Census, U.S. Department of Commerce
1980 & 90 *Census of Population 1980 and 1990.* Washington, D.C.
- Burger, A. E.
1995 "Inland Habitat Associations of Marbled Murrelets in British Columbia." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 151-61. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- California Coastal Commission
1995 "Procedural Guidance for Evaluating Wetland Mitigation Projects in California's Coastal Zone." Mimeograph document. San Francisco, CA. Copy on file at RNSP headquarters.
- California Department of Conservation, Division of Mines and Geology
1995 *Planning Scenario in Humboldt and Del Norte Counties, California, for a Great Earthquake on the Cascadia Subduction Zone*, by Tousson Topozada, Glenn Borchardt, and Wayne Hayden. Special Publication 115.
- California Department of Finance, Demographic Research Unit
1996 *Population and Housing Elements, Del Norte County and Humboldt County, Report E-5*, January 1, 1996 (Internet transcription).
- California Department of Fish and Game
1994 "Amphibian and Reptile Species of Special Concern in California" by M. R. Jennings and M. P. Hayes. Inland Fisheries Report. Sacramento, CA. Copy available at CDFG headquarters, Sacramento, CA.
- 1997 "Natural Diversity Data Base: Special Plant List." Quarterly publication. Sacramento, CA. Copy available at CDFG headquarters, Sacramento, CA.
- California Department of Forestry and Fire Protection
1988 "California's Forests and Rangelands: Growing Conflict over Changing Uses." Forest and Rangeland Assessment Program report. Sacramento, CA. Copy available at RNSP headquarters.
- California Department of Parks and Recreation
1982&83 *Inventory of Features: Jedediah Smith Redwoods State Park, Del Norte Coast Redwoods State Park, Prairie Creek Redwoods State Park.* Resources Protection Division, Natural Heritage Section, Cultural Heritage Planning Unit. Prepared for *State Redwoods Park General Plan*. Mimeograph on file at California Department of Parks and Recreation Northern Service Center, Sacramento, CA.
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Geology 8/83 by Syd Willard
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BIBLIOGRAPHY

- 1983a *Native American and Euro-American Resources in Jedediah Smith, Del Norte Coast, and Prairie Creek Redwoods State Parks*, by Joe. D. Hood and Carol Roland. Cultural Heritage Planning, Resource Protection Division, Sacramento, CA.
- 1983b "Plant Life" by S. P. Olive, F. S. Bowcutt, S. Bakken, and W. J. Barry, Jr. In *Inventory of Features: Jedediah Smith Redwoods State Park. Del Norte Coast Redwoods State Park. Prairie Creek Redwoods State Park*. Prepared for State Redwoods Parks General Plan. Mimeograph document. Resource Protection Division, Natural Heritage Section, Cultural Heritage Planning Unit. Sacramento, CA. Copy available at RNSP headquarters and CDPR office, Sacramento, CA.
- 1985 *State Redwoods Parks, General Plan*. Sacramento, CA. Copy available at RNSP headquarters in Crescent City.
- California North Coast Regional Water Quality Control Board
1997 *Water Quality Control Plan -- North Coast Region -- Region 1*. Santa Rosa CA.
- California Office of Emergency Services, Federal Emergency Management Agency, and Humboldt State University
1996 *Living on Shaky Ground -- How to Survive Earthquakes and Tsunamis on the North Coast*. Arcata, CA.
- Chase, Edwin P., J. C. Love, and Wihelmus S. Steenbakkers
1996 *Market Value Planners, Yurok Lodge Project Review and Pre-Architectural Programming/Feasibility Scoping*. Market Value Planners, Alamo, CA. Copy available at Yurok Tribe headquarters, Eureka, CA.
- Childers, E. L. , R. L. Wallen and Don Baldwin
1999 "Monitoring the northern spotted owl in Redwood National and State Parks 1993 to 1998." Annual project report. Resource Management and Science Division, Redwood National and State Parks. Orick, CA.
- Cowardin, Lewis M., V. Carter, F. C. Golet, and E. T. LaRoe
1979 *Classification of Wetlands and Deepwater Habitats of the United States*. Published by the U.S. Fish and Wildlife Service, U.S. Department of the Interior, FWS/OBS-79/31.
- Cussins, D.
1994 "Thinning Prescription for the Second - growth 'Whiskey-40' Study Area in Redwood National Park." Project Report NPS-1994. On file, Redwood National Park, Orick, CA.
- Divorky, G. J., and M. Horton
1995 "Breeding and Natal Dispersal, Nest Habitat Loss and Implications for Marbled Murrelet Populations." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 83-87. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Eidsness, Janet P.
1988 *A Summary of Cultural Resources Projects, Redwood National Park*. Arcata, CA. Copy available at RNSP offices in Arcata and Orick, CA.
- Falvey, B.
1998 "Snowy Plover Surveys." Annual report, Resource Management and Science Division, Redwood National and State Parks. Orick, CA.
- Federal Emergency Management Agency
1982 *Flood Insurance Rate Maps for Humboldt County*. Community Panel Numbers 0600-150B, 0600-0300B, 0600-1275B.
1983 *Flood Insurance Rate Maps for Del Norte County*. Community Panel Numbers 06025-0025B, 06025-0175B, 06025-0250B.
1986 *Flood Insurance Rate Maps for Del Norte County*. Community Panel Numbers 06025-0100C.

- Federal Interagency Committee for Wetland Delineation
1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture, Soil Conservation Service, cooperative publication., Washington, D.C. Copy available at RNSP headquarters.
- Forest Ecosystem Management Assessment Team (USDA Forest Service; USDI Bureau of Land Management, Fish and Wildlife Service, and National Park Service; US Department of Commerce National Oceanic and Atmospheric Administration and National Marine Fisheries Service; Environmental Protection Agency)
1993 *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* ("the FEMAT Report"). Report presented to the White House Office of Environmental Policy, July 1, 1993. On file at agency offices. Washington, D.C.
- Forsman, E. D., E. C. Meslow and H. W. Wight.
1984 "Distribution and Biology of the Spotted Owl in Oregon." No. 87, *Wildlife Monographs*.
- Franklin, J. R.
1988 "Pacific Northwest Forests" in *North American Terrestrial Vegetation*, M. G. Barbour and W. D. Billings, eds. Cambridge University Press, New York, pp. 104-130
- Gellman, S. T. And W. J. Zielinski
1996 "Use by Bats of Old-Growth Redwood Hollows on the North Coast of California." *Journal of Mammalogy* 77(1): 255-65.
- Grenier, J. J. and S. K. Nelson
1995 "Marbled Murrelet Habitat Associations in Oregon," in *Ecology and Conservation of the Marbled Murrelet*, Ralph et al tech. eds., pp. 191-204.
- Grossman Design Group
1990 *Overnight Accommodations Study, Del Norte County and Crescent City*, vol. 1. San Francisco, CA. Copy available at Humboldt County Library.
- Group 4\Architecture, Research and Planning, Inc.
1994 *Welcome Center Feasibility Study, City of Crescent City*. San Francisco, CA. Copy available at Crescent City Chamber of Commerce.
- Hagans, D. K., and Weaver, W. E.
1987 "Magnitude, Cause and Basin Response to Fluvial Erosion, Redwood Creek Basin, Northern California." In *Erosion and Sedimentation in the Pacific Rim Steeplands — Proceedings of a Symposium, Corvallis, Oregon, 1987*, R. L. Beschta, T. Blinn, G. E. Grant, G. G. Ice, and F. J. Swanson eds. International Association of Hydrological Sciences, IAHS-AISH Publication No. 165, p. 419-428.
- Hagans, Danny K., William E. Weaver, and Mary Ann Madej
1986 "Long Term On-site and Off-site Effects of Logging and Erosion in the Redwood Creek Basin, Northern California." In *Papers Presented at the American Geophysical Union Meeting on Cumulative Effects* (Dec. 9-13, 1985, San Francisco, CA. National Council of the Paper Industry, NY, NY. Technical Bulletin. no. 490:38-66, May.
- Hall, E. R.
1981 *The Mammals of North America*. 2 vols. 2nd ed. John Wiley and Sons, New York.
- Hamer T. E., and S. K. Nelson
1995 "Characteristics of Marbled Murrelet Nest Trees and Nesting Stands." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 69-82. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Hansen, Reed
1999 "RNSP — Regional Economic Impact Analysis." Copy on file at RNSP headquarters in Crescent City, CA.
- Hayes, M. P., and M. R. Jennings
1986 "Decline of Ranid Frog Species in Western North America: Are Bullfrogs (*Rana catesbiana*) Responsible?" *Journal of Herpetology* 20: 490-509.

BIBLIOGRAPHY

- Heaton, T. H. and H. Kanamori
1984 "Seismic Potential Associated with Subduction in the Northwestern United States." *Bulletin of the Seismological Society of America*. vol 74.
- Heaton, T. H. and S. H. Hartzell
1987 "Seismic Hazards on the Cascadia Subduction Zone." *Science*. 236:162-168.
- Hickman, J. C., ed.
1993 *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley and Los Angeles, California.
- Holland, R.F.
1986 "Preliminary Descriptions of the Terrestrial Natural Communities of California" by R. F. Holland. Sacramento, CA. Prepared for California Department of Fish and Game, The Resources Agency. Copy available at CDFG headquarters, Sacramento, CA.
- Iwamoto, R. N., E. O. Salo, M. A. Madej, and R. L. McComas
1978 "Sediment and Water Quality: A Review of the Literature including a Suggested Approach for Water Quality Criteria," EPA-910/9-78-048 (PB-279-048), U. S. Environmental Protection Agency, Seattle, WA.
- Johnson, D. R, and J. K. Agee
1988 "Introduction to Ecosystem Management," In *Ecosystem Management for Parks and Wilderness*, edited by J. K. Agee and D. R. Johnson, chapter 1. University of Washington Press: Seattle, WA.
- Jones and Stokes Associates, Inc.
1981 Ecological characterization of the central and northern California coastal region. Vol II, Part 1, Regional Characterization.
- Josselyn, M. N., M. Martindale, and J. M. Duffield
1989 "Public Access and Wetlands: Impacts of Recreational Use." Technical Report #9. Romberg Tiburon Centers, Center for Environmental Studies, San Francisco State University. Tiburon, CA. Copy available at RNSP offices in Arcata, CA.
- Knight, R. L. and K. J. Gutzwiller
1995 *Wildlife and Recreationists: Coexistence through Management and Research*. Island Press. Covelo, California. 372 pp.
- LaHaye, W. S.
1988 "Nest Site Selection and Nesting Habitat of the Northern Spotted Owl in Northwest California." M.S. thesis, Humboldt State University, Arcata, CA.
- Lammers, Phyllis A.
1997 *1997 Humboldt County Economic and Demographic Almanac*." North Coast Almanacs: Eureka, CA.
- Littlejohn, Margaret
1994 *Visitor Services Project, Redwood National Park*, Report 59. Cooperative Park Studies Unit. University of Idaho.
- Lloyd, D.S.
1987 "Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska." *North American Journal of Fisheries Management* 7:43-45.)
- Lloyd, D. S. J. P. Koenings, and J. D. LaPerriere
1987 "Effects of Turbidity in Fresh Waters of Alaska." *North American Journal of Fisheries Management* 7: 18-33
- Madej, M.A.
1992 "Cooperative Erosion Control Efforts Based on Sediment Transport Trends, Redwood Creek, North Coastal California." In *Interdisciplinary Approaches in Hydrology and Hydrogeology*, American Institute of Hydrology, p. 373-388.
- Mandel, R. D., and D. W. Kitchen
1979 "The Ecology of Roosevelt Elk in and around Redwood National Park." Prepared for the National Park Service. On file, Redwood National Park, Orick, CA.
- Martin O'Connell Associates
1991 *Humboldt Bay Development Plan, Final Report*. Wellesley, MA. Copy available at Humboldt County Library.
- Marzluff, J. M., R. B. Boone and G. W. Cox.
1994 "Historical changes in populations and perceptions of native pest bird species in the west." *Studies in Avian Biology* no.15:202-220.

- McLaughlin, J. C., and F. Harradine
1965 *Soils of Western Humboldt County, California*. Department of Soils and Plant Nutrition, University of CA. Davis, CA. 36 maps, 1:31680 scale
- Miller, S. L., and C. J. Ralph
1995 "Relationships of Marbled Murrelets with Habitat Characteristics at Inland Sites in California." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 205-15. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Muldavin, E. H., J. M. Lenihan, W. S. Lennox, and S. D. Veirs, Jr.
1981 "Vegetation Succession in the First Ten Years Following Logging of Coast Redwood Forests." Mimeograph document on file at Redwood National Park, Orick, CA.
- National Park Service, U.S. Department of the Interior
1975 *Management Options for Redwood Creek, Environmental Assessment*. Western Regional Office. San Francisco, CA.
- 1976 "Redwood National Park Statement for Management." San Francisco, CA. Available at RNSP office in Arcata, CA.
- 1980 *Redwood National Park, California, General Management Plan*. Denver Service Center, Denver, CO
- 1981 *Watershed Rehabilitation Plan, Redwood National Park*. Denver Service Center, Denver, CO.
- 1982a *Environmental Assessment, Redwood Information Center, Redwood National Park, California*. Denver Service Center. Denver, CO.
- 1982b "History, Basic Data, Redwood National Park, Del Norte and Humboldt Counties, California," by Edwin C. Bearss, Division of History, Office of Archeology and Historic Preservation. 1969, Reprint. Copy available at RNSP offices in Arcata and Orick, CA.
- 1983a "Finding of No Significant Impact and Floodplain Statement of Findings for the Redwood Information Center, Redwood National Park." Crescent City, CA and Western Regional Office, San Francisco. Copy available at RNSP offices in Arcata and Orick, CA.
- 1983b "Management Alternatives for the Redwood Creek Estuary" by Terry Hofstra. Copy available at RNSP offices in Arcata and Orick, CA.
- 1984 *Redwood National Park Backcountry Trail Plan*. Redwood National Park.
- 1985 *Water Resources Management Plan, Redwood National Park: An Amendment to the Natural Resources Management Plan*. Redwood National Park. Copy available at Denver Service Center, Technical Information Center and RNSP offices in Arcata and Orick, CA.
- 1994 *Resources Management Plan*. Redwood National Park. Copy available at Denver Service Center, Technical Information Center and RNSP offices in Arcata and Orick, CA.
- 1992 *Bald Hills Vegetation Management Plan and Environmental Assessment*. Redwood National Park. Copy available at RNSP offices in Arcata and Orick, CA.
- 1995 *Exotic Plant Management Plan and Environmental Assessment*. Redwood National Park. Copy available at RNSP offices in Arcata and Orick, CA.
- 1995a *Davison Ranch Development Concept Plan/Environmental Assessment*. Copy available at RNSP offices in Arcata and Orick, CA.
- 1995b *Fire Management Plan, Redwood National Park*. Copy available at RNSP offices in Arcata and Orick, CA.
- 1997a "Director's Order #18: Wildland Fire Management." Draft. Washington, D.C. Copy available at RNSP offices in Arcata and Orick, CA.
- 1997b "Museum Management Plan." In-house draft. Redwood National and State Parks, Arcata, CA. Copy available at RNSP offices in Arcata and Orick, CA.

BIBLIOGRAPHY

- 1997c *Oregon Caves National Monument Draft General Management Plan and Environmental Impact Statement*. Seattle, WA. Copy available at RNSP offices in Arcata and Orick, CA.
- 1998 *Redwood Creek Watershed Analysis* in press. Copy available at RNSP offices in Arcata and Orick, CA.
- Natural Resources Conservation Service
1995 "Changes in Hydric Soils of the United States." *Federal Register* 60(37):10349. February 24, 1995.
- Nelson, S. K., and T. E. Hamer
1995a "Nesting Biology and Behavior of the Marbled Murrelet." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 57-67. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- 1995b "Nest Success and the Effects of Predation on Marbled Murrelets." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 89-97. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Nolan, K. M., and R. J. Janda
1981 "Use of Short-term Water and Suspended Sediment Discharge Observations to Assess Impacts of Logging on Stream-sediment Discharge in the Redwood Creek Basin, Northwestern California U.S.A." In *Erosion and Sediment Transport in Pacific Rim Steeplands*, edited by T. R. Davies and A. J. Pearce. International Association of Hydrological Sciences Publication No. 132, p. 415-437.
- Oliver, C. D.
1981 "Forest Development in North America Following Major Disturbances." *Forest Ecology and Management* 3:153-168.
- Orr, R. T., and R. C. Helm
1989 *Marine Mammals of California*. Rev. ed. University of California Press. Berkeley, CA.
- Page, G. W. and L. E. Stenzel
1981 "The Breeding Status of the Snowy Plover in California." *Western Birds* 17:145-170.
- Page, G. W., J. S. Warriner, J. C. Warriner, and P. W. C. Paton
1995 "Snowy Plover" in *The Birds of North America*, No. 154. A. Poole and F. Gill eds. The Academy of Natural Sciences, Philadelphia, PA and the American Ornithologists' Union, Washington D. C.
- Paton, P. W. C.
1995 "Marbled Murrelet Inland Patterns of Activity: Defining Detections and Behavior." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 113-116. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Pearson, O. P., M. R. Koford, and A. K. Pearson.
1952 "Reproduction of the Lump-nosed Bat (*Corynorhinus rafinesquei*) in California." *Journal of Mammalogy* 33(1): 272-320.
- Pierson, E. D. And W. E. Rainey
1994 "The Distribution, Status, and Management of Townsend's Big-eared Bat (*P. townsendii*) in California. Report to the California Department of Fish and Game, Sacramento, CA.
- Perry, D. A.
1995 "Status of Forest Habitat of the Marbled Murrelet." In *Ecology and Conservation of the Marbled Murrelet*, by C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds., pp. 381-83. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Popenoe, J. H., K. A. Bevis, B. R. Gordon, N. K. Sturhan, and D. L. Hauxwell
1992 "Soil-Vegetation Relationships in Franciscan Terrain of Northwestern California." *Soil Science Society of America Journal* 56:1951-1959.

- Ralph, C. J. and S. L. Miller
1995 "Offshore Population Estimates of Marbled Murrelets in California, in *Ecology and Conservation of the Marbled Murrelet*, C. J. Ralph, George L. Hunt Jr., Martin G. Raphael, and John F. Piatt tech. eds. Gen. Tech. Rep. PSW--GRT-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Ralph, C. J., G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds.
1995 "Ecology and Conservation of the Marbled Murrelet in North America: An Overview." In *Ecology and Conservation of the Marbled Murrelet*, pp. 3-22. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Ralph, C. J., G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, tech. eds.
1995 *Ecology and Conservation of the Marbled Murrelet*. Gen. Tech. Rep. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.
- Redding, J. M. and C. B. Schreck
1980 "Chronic Turbidity and Stress in Juvenile Coho Salmon and Steelhead Trout," Report PNW-1705-16, U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Corvallis, OR.
- Ricker, W. E.
1972 "Heredity and Environmental Factors Affecting Certain Salmonid Populations: The Stock Concept in Pacific Salmon." in H. R. McMillan Lectures in Fisheries. Simon, H. R., and P. A. Larkin, eds., pp. 19-60. University of British Columbia. Vancouver, Canada.
- Ricks, C. L.
1983 "Flood History and Sedimentation of the Mouth of Redwood Creek, Humboldt County, California." M.S. thesis, Oregon State University, Corvallis, OR.
1985 "Flood History and Sedimentation of the Mouth of Redwood Creek, Humboldt County, California." Prepared for the National Park Service. Technical Report 15. Redwood National Park. Orick, CA.
- Rogers, G. C.
1988 "An Assessment of the Megathrust Earthquake Potential of the Cascadia Subduction Zone." *Canadian Journal of Earth Sciences*. 25:844-852.
- Rohde, Jerry and Gisela
1994 *Redwood National & State Parks: Tales, Trails, & Auto Tours*. Mountain Home Books, McKinleyville, CA 95521.
- Satake, K., K. Shimazaki, Y. Tsuji, and K. Ueda
1996 "Time and Size of a Giant Earthquake in Cascadia Inferred from Japanese Tsunami Records of January 1700." *Nature*, vol 379, no. 6562. Pp. 246-249. January 1996.
- Schenck, S. M., and E. W. Gifford
1952 "Karuk Ethnobotany." University of California, Anthropological Records 13: 377-392.
- Scott, W. B., and E. J. Crossman
1973 "Freshwater Fishes of Canada." Bulletin 184. Fisheries Research Board of Canada: Ottawa, Canada.
- Soil Conservation Service, U. S. Department of Agriculture
1991 *Hydric Soils of the United States*. Soil Conservation Service Miscellaneous Publication 430. U.S. Government Printing Office. Washington, D.C.
- Solis, D. M. Jr.
1983 "Summer Habitat Ecology of Spotted Owls in Northwestern California." M. S. thesis, Humboldt State University, Arcata, Ca.
- Spreiter, T. A., J. F. Franke, and David L. Steensen
1995 "Disturbed Lands Restoration: The Redwood Experience." *8th Conference on Research and Resource Management in Parks and Public Lands*, April 17-21, 1995, Portland, Oregon. George Wright Society, Hancock, Michigan.
- Stebbins, R. C.
1985 *A Field Guide to Western Reptiles and Amphibians*. Peterson Field Guide Series #16. Houghton Mifflin Company. Boston, MA.

BIBLIOGRAPHY

- Steensen D. L., and T. A. Spreiter
 1992 "Watershed Rehabilitation in Redwood National Park." Paper presented at the 1992 National Meeting of the American Society for Surface Mining and Reclamation, June 18, 1992, Duluth, Minnesota.
- Steinberg, S.
 1993 "Threatened & Endangered Wildlife Species, Annual Report." Redwood National Park, Resource Management and Science Division, Redwood National and State Parks. Orick, CA.
- Stone, E. C.
 1966 "Ecology of the Watershed. A Case Study at Bull Creek." In *Proceedings of a Symposium for Park Preservation. Humboldt State Redwoods State Park, California*, May 13-14, 1966, Scotia, CA. School of Forestry, University of California, Berkeley.
- 1967 "The Redwood Park Proposals. A Forest Scientist's View." *Journal of Forestry* 65:320-321.
- Stone, E.C., and R. B. Vasey
 1968 "Preservation of Coast Redwood on Alluvial Flats." *Science* 159: 157-161.
- Tanner, R. G., and R. J. Gutierrez
 1996 "A Partial Inventory of Northern spotted owls (*Strix occidentalis caurina*) in Redwood National Park, 1995." Annual report to National Park Service, Redwood National Park. Cooperative Agreement No. CA 8480-3-9005
- Thomas, J. W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner
 1980 "A Conservation Strategy for the Northern Spotted Owl." USDA Forest Service, Pacific Northwest Forest and Range Experimental Station, Portland, OR. Copy available at USDA Forest and Range Experimental Station, Portland, OR
- Tiner, R. W.
 1997 "NWI Maps: What They Tell Us." In *National Wetlands Newsletter*, March-April, pp. 7-12.
- U. S. Army Corps of Engineers.
 1987 *Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1.* Environmental Laboratory, Waterways Experiment Station, Vicksburg, MS. Copy available COE office in Eureka, CA.
- 1994 "Redwood Creek Estuary Proposed Restoration Plans Hydrologic and Hydraulic Analysis." Letter and report to Redwood National Park. December 7, 1994.
- USDA Forest Service; USDI Bureau of Land Management, Fish and Wildlife Service, and National Park Service; US Department of Commerce National Oceanic and Atmospheric Administration and National Marine Fisheries Service; Environmental Protection Agency
 1993 FEMAT report — see Forest Ecosystem Management Assessment Team
- U.S. Department of Commerce, National Marine Fisheries Service, and National Oceanic and Atmospheric Administration
 1995a "Endangered and Threatened Species; Proposed Threatened Status for Southern Oregon and Northern California Steelhead," 50 CFR part 227. *Federal Register*, September 18, 1995. Vol. 60, no. 180, p. 48086.
- 1995b "Endangered and Threatened Species; Proposed Threatened Status for Three Contiguous ESUs of Coho Salmon Ranging from Oregon through Central California." *Federal Register* Vol. 60, No. 142, pp. 38011-38030.
- 1996 "Endangered and Threatened Species: Proposed Endangered Status for Five ESUs of Steelhead and Proposed Threatened Status for Five ESUs of Steelhead in Washington, Oregon, Idaho, and California," 50 CFR parts 222 and 227. *Federal Register*, August 9, 1996. Vol. 61, no. 155, pp. 41541-41561.
- 1997a "Endangered and Threatened Species; Interim Rule Governing Take of Threatened Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon." *Federal Register*, July 18, 1997. Vol. 62, no. 138, pp. 38479-38485.

- 1997b "Endangered and Threatened Species; Threatened Status for Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon," 50 CFR part 227. *Federal Register*, May 6, 1997. Vol. 62, no. 87, pp. 24588-24609.
- 1997 Designated Critical Habitat; Central California Coast and Southern Oregon/Northern California Coast Coho Salmon. *Federal Register*, November 25, 1997. Vol. 62, no. 227, pp. 62741-62751.
- 1998a Endangered and Threatened Species: Proposed Endangered Status for Two Chinook Salmon ESUs and Proposed Threatened Status for Five Chinook Salmon ESUs; Proposed Redefinition, Threatened Status, and Revision of Critical Habitat for One Chinook Salmon ESU; Proposed Designation of Chinook Salmon Critical Habitat in California, Oregon, Washington, Idaho. *Federal Register*, March 9, 1998. Vol. 63, no. 45, pp. 11481-11520.
- 1998b Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California. *Federal Register*, March 19, 1998. Vol. 63, no. 53, pp. 13347-13371.
- U. S. Department of the Interior, Heritage Conservation and Recreation Service
1980 *Final Environmental Impact Statement. Proposed Designation of Five California Rivers in the National Wild and Scenic Rivers System.* San Francisco, CA. Copy available at RNSP headquarters.
- U.S. Department of Transportation, Federal Highway Administration
1995 "Best Management Practices for Erosion and Sediment Control," Report No. FHWA-FLP-94-005.
- U.S. Department of Transportation, Federal Highway Administration, and State of California Department of Transportation
1994 *Draft Environmental Impact Statement/Report. Route 101 Realignment Construction at Cushing Creek from 8.5 to 5.3 kilometers (5.3 - 3.3 miles) South of Crescent City, Del Norte County, California.* California Department of Transportation, Eureka, CA. Copy available at RNSP office in Arcata, CA.
- U.S. Environmental Protection Agency
1998 Total Maximum Daily Loads for Sediment. Redwood Creek. California. December 30, 1998. EPA Region 9, San Francisco, CA. Also available on the Internet at www.epa.gov/region09/water/tmdl
- U.S. Fish and Wildlife Service, U.S. Department of the Interior
1979 *Classification of Wetlands and Deepwater Habitats of the United States.* See Cowardin et al.
- 1987 *National Wetlands Inventory.* Maps 1:58,000. Childs Hill; Crescent City; Fern Canyon; Hiouchi; Orick; Requa; Rodgers Peak; Sister Rocks quadrangles. Washington, DC.
- 1990 "Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Northern Spotted Owl," 50 CFR part 17. *Federal Register*, June 16, 1990. Vol. 55, no. 123, pp. 26114-26194.
- 1991 *Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Northern Populations of the Tidewater Goby from the List of Endangered and Threatened Wildlife.* 50 CFR Part 17. *Federal Register*, June 24, 1999. vol. 64, no. 121, pp. 33816-33825.
- 1993 "Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Western Snowy Plover," 58 *Federal Register*, 12864. March 5, 1993.
- 1994 "Endangered and Threatened Wildlife and Plants; Proposed Endangered Status for the California Red-legged Frog," 50 CFR part 17. *Federal Register*, February 2, 1994. Vol. 59, no. 22, pp. 4888-4895.
- 1996a "Endangered and Threatened Wildlife and Plants: Final Designation of Critical Habitat for the Marbled Murrelet: Final Rule," 50 CFR part 17. *Federal Register*, May 24, 1996. Vol. 61, no. 102, pp. 26255-26320.
- 1996b "Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Threatened or Endangered," 50 CFR part 17. *Federal Register*, February 28, 1996. Vol. 61, no. 40, pp. 7595-7613.

BIBLIOGRAPHY

- 1997 "Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California." Portland, OR.
- 1999a Endangered and Threatened Wildlife and Plants; Final Rule to Remove the American Peregrine Falcon from the Federal List of Endangered and Threatened Wildlife, and to Remove the Similarity of Appearance Provision for Free-Flying Peregrines in the Conterminous United States; Final Rule. 50 CFR Part 17. *Federal Register*, August 25, 1999. Vol. 64, no 164, pp. 46541-46558.
- 1999b Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Northern Populations of the Tidewater Goby from the List of Endangered and Threatened Wildlife. 50 CFR Part 17. *Federal Register*, June 24, 1999. Vol. 64, no 121, pp. 33816-33825.
- U.S. Forest Service, U.S. Department of Agriculture
1993 *Micro IMPLAN Users Guide*. Land Management Planning Systems Group, Fort Collins, CO. Copy available at USFS office in Eureka, CA.
- 1995a *Land and Resource Management Plan: Six Rivers National Forest*. Eureka, CA. Copy available at RNSP office in Arcata, CA.
- 1995b *Six Rivers National Forest Plan and Final Environmental Impact Statement. Land and Resource Management Plan and Appendices*. Eureka, CA. Copy available at RNSP office in Arcata, CA.
- U.S. Forest Service, U.S. Department of Agriculture, and Bureau of Land Management, U.S. Department of the Interior
1994a *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl and the Record of Decision*. GPO: Portland, OR (Region 10).
- 1994b "Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl. Portland, OR Copy available at RNSP headquarters.
- 1995 "Decision Notice/Decision Record and Finding of No Significant Impact. Environmental Assessment for the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California." Copy available at RNSP headquarters.
- U.S. Geological Survey, U.S. Department of the Interior
1975 "Watershed Conditions in the Drainage Basin of Redwood Creek, Humboldt County, California," by R. J. Janda, K. M. Nolan, D. R. Harden, and S. M. Colman. U.S. Geological Survey Open-File Report 75-568. Government Printing Office: Washington, D.C. Copy available at RNSP headquarters.
- 1995 "History of Timber Harvest in the Redwood Creek Basin, Northwestern California," by Dave Best. In *Geomorphic Processes and Aquatic Habitat in the Redwood Creek Basin, Northwestern California*, K. M. Nolan, H. M. Kelsey, D. C. Marron, eds. U.S. Geological Survey Professional Paper 1454-C, p. C1-C7.
- 1997 Stream gage data for the Smith River station # 11532500, Klamath River station # 11530500, and Redwood Creek station # 11482500. Compiled by Kim Hanson, Sacramento, CA.
- Veirs, S. D., Jr.
1972 "Ecology of the Coast Redwood." On file at RNSP headquarters, Crescent City, CA
- 1980 "The Role of Fire in Northern Coast Redwood Forest Dynamics." In *Proceedings of the Conference on Scientific Research in the National Parks*. Vol. 10: Fire Ecology, pp. 190-209. National Park Service: Washington, D.C.

- 1982 "Coast Redwood Forest: Stand Dynamics, Successional Status and the Role of Fire" in J. E. Means (ed.) *Forest Succession and Stand Development Research in the Northwest*, . Pp. 119-141. Forest Research Laboratory, Oregon State University, Corvallis, OR. Copy available at RNSP headquarters.
- 1986 "Redwood Second-growth Forest Stand Rehabilitation Study, Redwood National Park: Evaluation of 1978-79 Thinning Experiments, Redwood National Park." On file, Redwood National Park, Orick, CA.
- Veirs, S. D., and W. S. Lennox
1981 "Rehabilitation and Long-term Park Management of Cutover Redwood Forests: Problems of Natural Succession." Paper presented at Symposium of Watershed Rehabilitation in Redwood National Park and Other Pacific Coastal Areas. Arcata, CA. On file in Redwood National Park, Arcata, CA.
- Waethrich, B.
1994 "It's Official: Quake Danger in Northwest Rivals California's." *Science* 265 pp. 1802-1803.
- Wallen, R. L., C. Arguello, J. Friedman, and Don Baldwin
1999 "The Corvids of Redwood National and State Parks: What Is Their Relative Abundance and How Does Abundance Vary Relative to Human Activities in the Forest?" Annual progress report, Resource Management and Science Division, Redwood National and State Parks. Orick, CA.
- Wallen, R. and E. Childers
1997 "A Biological Assessment of the Impacts to Threatened and Endangered Species from Annual Maintenance (Facilities, Roads, and Trails) in Redwood National and State Parks." Available at RNSP office in Orick, CA
- Ward, J. P., Jr.
1990 "Spotted Owl Reproduction, Diet and Prey Abundance in Northwest California." M. S. thesis, Humboldt State University, Arcata, CA.
- Wistar, I. J.
1937 *Autobiography of Issac Jones Wistar, 1827-1905: Half a Century in War and Peace*. Wistar Institute of Anatomy and Biology, Philadelphia, PA.
- Yurok Tribe, Office of Planning and Community Development
1996 *Yurok Overall Economic Development Plan, Annual Review and Program Modification, Fiscal Year 1997-98*. Eureka, CA. Copy available from Yurok Tribe.

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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