DRAFT ENVIRONMENTAL ASSESSMENT

EROSION PREVENTION ON SIERRA-PACIFIC INDUSTRIES AND HERB RUSS ESTATE LANDS UPPER REDWOOD CREEK BASIN

April 16, 1998

REDWOOD NATIONAL PARK
HUMBOLDT COUNTY, CALIFORNIA

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE
FISH AND WILDLIFE SERVICE

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INTRODUCTION

Redwood National Park was created and expanded to protect old-growth coastal redwoods growing along Redwood Creek, including the world-famous Tall Trees Grove. After creation of the park in 1968, the grove was protected from harvesting, but old-growth streamside redwoods along the main stem of Redwood Creek were still at risk from flooding and impacts from sediment originating from upstream timber harvest activities. Recognizing the relation between upstream land uses and sediment deposition in Redwood Creek, Congress passed park expansion legislation (PL 95-250) in 1978.

Public Law 95-250 directed Redwood National Park to develop and implement "a program for the rehabilitation of areas within and upstream from the park contributing significant sedimentation because of past logging disturbances and road conditions ...." In 1981, the National Park Service prepared a Watershed Rehabilitation Plan (NPS, 1981) to guide development and implementation of a watershed restoration program that would reduce sedimentation from over 400 miles of logging haul roads within the park boundaries in Redwood Creek. Since that time, nearly 200 miles of roads have been treated under this program.

The expansion legislation also directed the National Park Service to work cooperatively with private landowners upstream of the park to reduce erosion and, hence, the threat to streamside redwoods, along Redwood Creek, within park boundaries.

The National Park Service signed a Memorandum of Understanding (MOU) in 1995 that provided a basic framework for cooperative erosion prevention work on private lands in the upper Redwood Creek basin (NPS, 1995). These agreements were complemented by cooperative agreements with the Bureau of Land Management, U.S. Fish and Wildlife Service, and the Humboldt County Resources Conservation District. Several small erosion prevention projects have been completed since that time. The park also cooperates with private landowners during the field review of proposed timber harvest plans, and when conducting hydrologic and geologic studies. Although state forest practice rules have improved since park expansion, erosion from logging haul roads remains the single largest threat to the aquatic and riparian resources of Redwood Creek, and to the old-growth, streamside redwoods within the park boundaries.

Under the MOU, private landowners agree to work cooperatively with park staff to find and fix erosional problems associated with logging roads in the upper Redwood Creek basin. In cooperation with Sierra-Pacific Industries (SPI), Simpson Timber Company, the U.S. Forest Service, and several smaller landowners, Redwood National Park geologists completed a detailed field inventory of nearly 100 miles of roads in 1996. Based on this inventory, the total treatable erosion potential from all sites was estimated to be 103,000 cubic yards (Bundros and Hill, 1997). During this same period of time, Natural Resources Management Corporation (NRM) of Eureka, California, the land manager for the Estate of Herb Russ (Russ lands), performed a road inventory of nearly 30 miles of roads. The estimated erosion potential from these roads was estimated to be 28,000 cubic yards.

This environmental assessment describes a no-action alternative under which the current management of logging haul roads on private lands would continue unchanged, and two action alternatives for preventing erosion from roads on private lands, upstream of the park, in the Redwood Creek basin. The impacts of these alternatives are also described. The action alternatives proposed in this environmental assessment would treat 18 miles of roads on SPI lands and about 10 miles of roads on Russ lands. A total of 63,100 cubic yards of sediment would be prevented from entering streams.

Purpose and Need for Action

The purpose of this action is to reduce sediment delivery to Redwood Creek by preventing erosion from logging haul roads on private lands in the upper Redwood Creek basin. This action is needed to protect and maintain the aquatic habitat for anadromous fish, and to protect the riparian resources, including old-growth redwoods, along Redwood Creek within the park boundaries. The need is based upon the documented impacts from past land use and large storms, and the high potential for similar impacts to recur during the next large storm. The upper two-thirds of the Redwood Creek basin, upstream of Redwood National Park, is managed primarily for ranch and commercial timber production (Figure 1). These land management activities are expected to continue.

Tectonic activity has created steep hillslopes and highly erodible soils in the Redwood Creek basin. High rainfall combines with these basin characteristics to produce naturally high sediment loads. Scientific studies performed in Redwood Creek associate timber harvest activities with sediment loads above naturally high levels (Best and others, 1995; Hagans and Weaver, 1987; Harden, 1995; Harden and others, 1995; Janda and others, 1975). During a period of high streamflows in the 1970's, Janda and others (1975) estimated the sediment yield from logged basins was 17 times greater than the sediment yield from nearby, unlogged basins. Increased sediment from past floods caused Redwood Creek to fill and widen, resulting in the death of streamside redwoods, streambank erosion, and a major reduction in the amount of suitable habitat for coho salmon, steelhead trout, and other anadromous fish.

In a watershed analysis of the Redwood Creek basin, roads in the upper basin were identified as a major cause of accelerated erosion and resultant loss of habitat for salmonid populations (NPS, 1997a). Over 1,000 miles of logging roads, about four times the road mileage on parklands, are located on private lands upstream of the park (Figure 2). Of these 1,000 miles, only about half were being maintained as of 1992 (NPS, 1997a). Following the most recent large storm on January 1, 1997, widespread failures of logging roads were observed throughout the Redwood Creek basin, both within and outside of the park.

Large erosional processes during major storms can occur at stream crossings, along roads between stream crossings and at log landings. Gully erosion occurs at a stream crossing (the intersection of roads and streams) when a culvert plugs, streamflow overtops the crossing, and erodes the crossing fill. Even greater erosion can occur off-site, away from the crossing, when a culvert plugs, and streamflow is diverted from its natural drainage and flows down a road. The

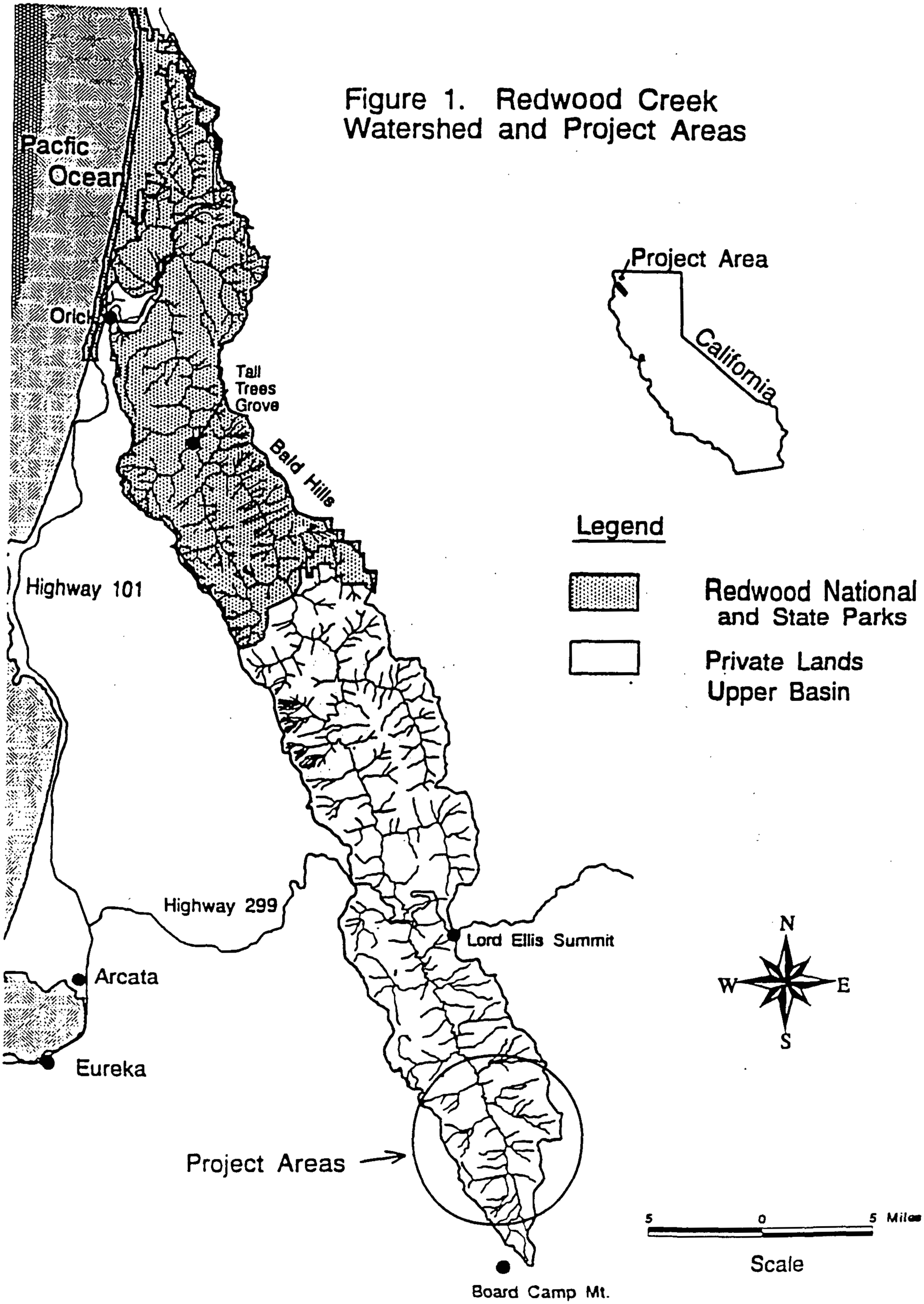
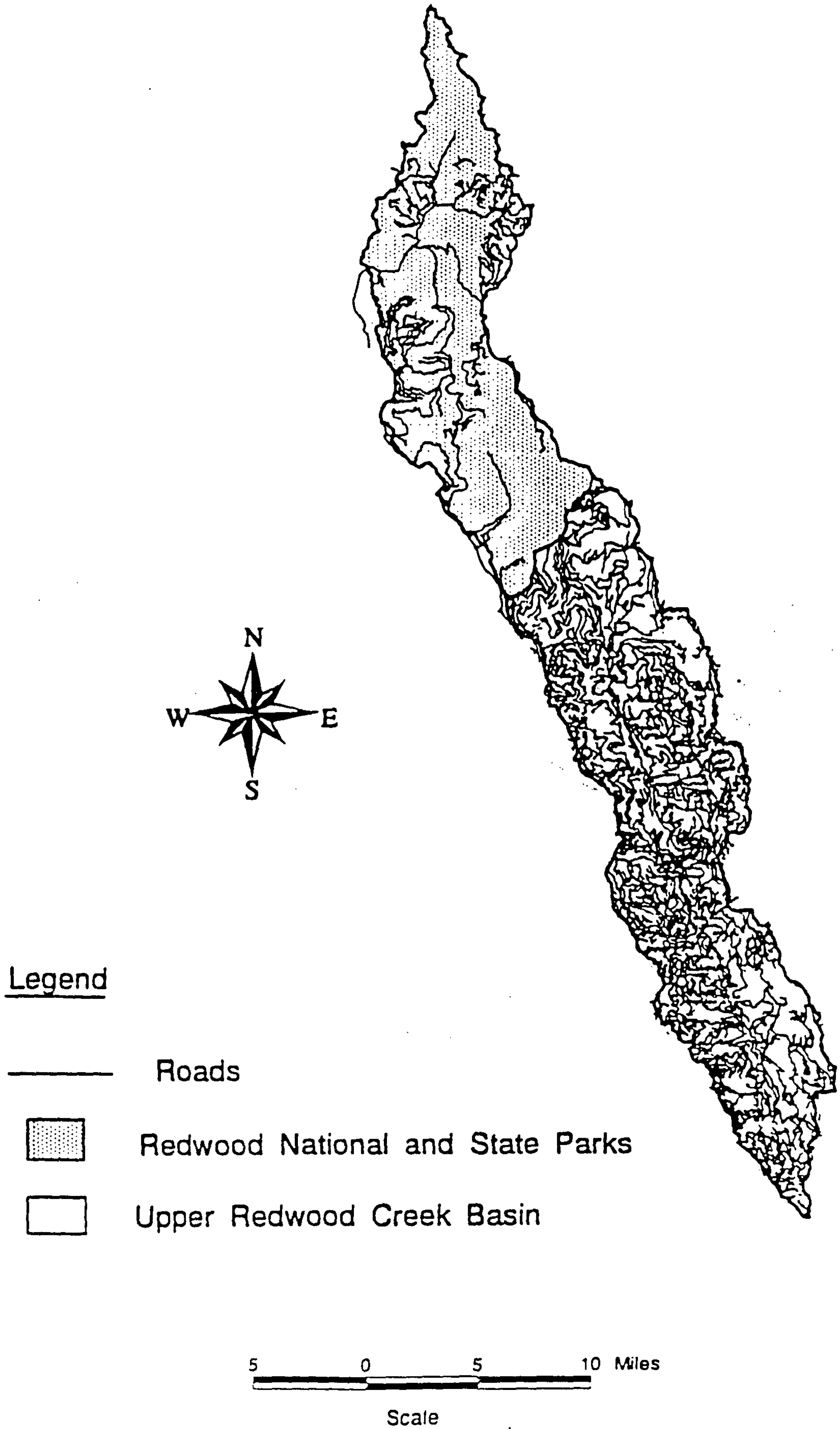


Figure 1. Redwood Creek Watershed and Project Areas

Figure 2. Roads in the Redwood Creek Basin



diverted stream may eventually leave the road and flow down onto a hillslope, where deep gully and landslide erosion occur. Studies in the Redwood Creek basin show that gully and landslide erosion from stream diversions can account for as much as 60% of the total erosion in a tributary basin during a large storm (Weaver and others, 1995; Best and others, 1995).

Landslide erosion can occur along roads that have uncontrolled surface drainage and excessive amounts of road fill placed on steep slopes. Landslides also occur at log landings (areas where logs are loaded onto trucks) built on steep hillslopes when excessive amounts of soil and woody debris have been pushed out along the landing's outer edge.

Assuming the landscape's sensitivity to erosion is uniform throughout the Redwood Creek basin, the total erosion potential (the sum of all volumes of sediment that could erode from individual sites) during a 50-year storm from roads in the Redwood Creek basin is estimated to be 5.2 million cubic yards. Of this amount, 85 percent is associated with roads on private lands upstream of the park (NPS, 1997b). This estimate is based upon inventories of road conditions and potential sediment source volumes inside the park, and extrapolated to the entire basin. This preliminary estimate is most likely conservative, because there are more erodible geologic units upstream of the park, and off-site cumulative impacts from road failures are difficult to estimate without considerable field work. For example, a streamside landslide that is caused by a stream crossing failure is an offsite cumulative impact. As the crossing fails, a large amount of sediment can be deposited directly in the stream channel, downstream of the failing crossing. As the channel fills rapidly with sediment, the channel and streamflow widen during peak storm flows. The offsite cumulative impact occurs when the stream cuts laterally into the streamside area, and initiates the landslide processes.

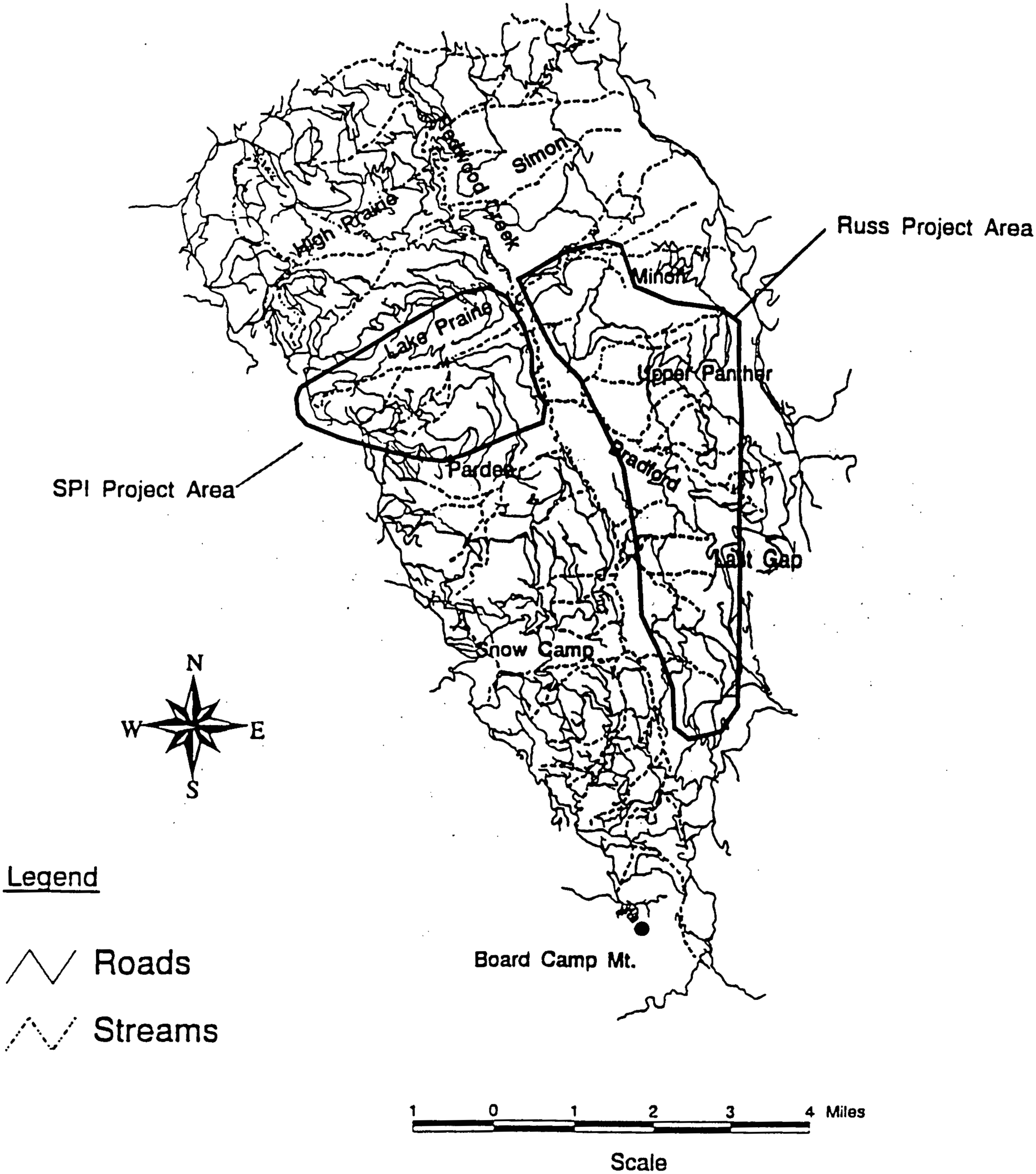
Description of Project Areas

This environmental assessment describes work that would be performed in two separate projects, the SPI project and the Russ project. Both project areas are located in the uppermost one-third of the Redwood Creek basin in Humboldt County, California on opposite sides of Redwood Creek. This part of Redwood Creek is located about 25 miles east of the city of Eureka, California, begins about 3 miles upstream from State Highway 299, and is about 18 miles upstream of the boundary of Redwood National Park (Figure 3).

The SPI project area is located on the west side of Redwood Creek within portions of T5N, R3E, Sections 24, 25 and T5N, R4E, Sections 19, 20, 29, 30, Humboldt Meridian. This project area includes the entire tributary basin of Lake Prairie Creek (2,200 acres) where elevations range from 1600 feet to almost 3500 feet above sea level. Lake Prairie Creek was selected because it supports anadromous and resident fish populations, and had the highest total erosion potential of all other areas inventoried in the upper basin by the park in 1996.

The Russ project area is located on the east side of Redwood Creek within portions of T5N, R4E, Sections 8-10, 15-18, 21-23, 26-28, 33, 34 and T4N, R4E, Sections 2, 3, 10, 11, 13-15, Humboldt Meridian. Tributaries within this project area include Simon Creek (1,100 acres),

Figure 3. Sierra-Pacific Industries and Russ Project Areas



Minon Creek (2,700 acres), Upper Panther Creek (1,600 acres), Bradford Creek (2,400 acres), and several smaller unnamed streams. Elevations range from 1500 feet to almost 5000 feet above sea level. The entire Russ project area contains about 3800 acres of land owned by the Estate of Herb Russ and managed by NRM.

Funding Sources, Cost Share and other Agreements

Funds will be provided by the Jobs-in-the-Woods Program, the National Park Service, and landowners. The Jobs-in-the-Woods Program, administered by the U.S. Fish and Wildlife Service (USFWS), as part of the President's Northwest Forest Plan, will provide a total of $190,697, including $99,400 for SPI lands and $91,297 for Russ lands. The funds were awarded by the USFWS to Redwood National Park for work on SPI lands, and to NRM for work on Russ lands through a competitive grant process. Landowner contributions will include $104,000 plus rock supply from SPI, and $16,400 from the Estate of Herb Russ. Redwood National Park will contribute $10,000 for heavy equipment work on Russ lands, and about $15,000 of staff time to plan, design, implement and supervise project work.

As part of the landowner agreements, SPI and the Estate of Herb Russ will maintain road improvements for a period of at least 10 years following completion of this work.

These projects represent a cooperative effort between government and private landowners to prevent erosion from logging haul roads in the Redwood Creek basin, upstream of the park. Landowner participation with this effort is strictly voluntary, and their willingness to participate is critical to erosion prevention efforts. The authority for the National Park Service to engage in such cooperative efforts is contained in the legislation establishing (PL90-545, Subsection 3(e)) and expanding (PL 95-250, Subsection 101 (a6)) Redwood National Park.

ALTERNATIVES

Alternatives Considered but Not Selected for Detailed Analysis

An alternative under which all of the roads inventoried in 1996 would be treated was considered, but was not selected for detailed analysis. Such an alternative would have treated about 130 miles of road and over 130,000 cubic yards of erosion potential. Because implementation funds are limited, a project of this size would not be feasible at current funding levels.

An alternative under which similar work would be implemented on other private lands was considered, but was not selected for detailed analysis. Landowner participation with these kinds of projects is strictly voluntary. Moreover, current state forest practice rules do not require long-term road maintenance or erosion prevention work, once timber harvest has been completed. Therefore, this alternative was not selected for further analysis because, in 1996, only SPI and the Estate of Herb Russ were interested in inventorying their roads for erosional problems. Road inventories are a prerequisite to cost-effective erosion prevention work.

An alternative under which all abandoned roads would be removed and original landforms restored, and all other haul roads reconstructed to higher standards was considered, but was not selected for detailed analysis. All abandoned roads do not contribute large volumes of sediment to streams. Thus, removing all abandoned roads would be neither compatible with the future management of these private lands, nor necessary. Landform restoration is a valued approach to restoring various attributes of a disturbed landscape, and is appropriate for lands that contain high public trust values, like national and state parks. The project areas, however, are private timber and ranch lands where landform restoration would be inappropriate, because the scope of projects are limited to erosion prevention. Finally, many previously constructed roads in the project areas are stable, and do not contribute large volumes of sediment to streams. Thus, spending limited resources to upgrade stable roads would not be cost-effective.

Terms Used in Discussions of Alternatives

Abandoned roads: receive little or no use, and have not been maintained. They may or may not be drivable, and/or may be partially or completely overgrown.

Erosion potential: the volume of material, expressed in cubic yards, that is likely to erode from a particular site. The volume is determined during a detailed field assessment of road conditions, commonly referred to as a "road inventory". Erosion potentials are estimated at several different types of sites, including stream crossings, road areas between stream crossings, and log landings.

Stream diversion: the diversion of a stream from its natural channel and watercourse. Stream diversions occur at stream crossings on roads that have continuous grades (the road is not flat) through the stream crossing. When a culvert plugs or can not handle the amount of streamflow during a large storm, the stream will backup behind the crossing, and will eventually rise to the road's surface. Once on the road, the stream will leave its natural watercourse, and flow down the road, rather than across the road.

Diversion potential: refers to a stream crossing where a stream diversion could occur.

Decommissioning a road: the permanent or temporary closure of a road. Permanent decommissioning would occur on roads that were originally built in highly unstable terrain, where environmental and maintenance costs are high. Future use of permanently decommissioned roads is not anticipated, but alternate routes might be constructed in the future to regain road access to areas that would be rendered inaccessible.

Temporary decommissioning would occur on roads that are not needed in the immediate future. Temporarily decommissioned roads might be rebuilt in the future, but would likely be rebuilt as temporary roads that would be decommissioned again at the completion of timber harvest operations.

Potential sediment sources from roads are treated when the roads are decommissioned. Following treatment, decommissioned roads are no longer drivable and are left maintenance-free.

Outsloping: completely reshapes roads and landings to prevent landslide erosion. The fill from the outer edge is removed (excavated) and placed along the inside edge where it is shaped to blend with the surrounding topography. Outsloping also re-establishes the natural surface drainage patterns that existed prior to human activities. No other drainage treatment is needed.

Pulling back: unstable fill from the outer edge of a road or landing is removed (excavated by heavy equipment) and stored at a stable location. Pulling back unstable fill from along the outer edge of a road reduces the width of the road and driving surface, but leaves the road drivable.

Rolling dips: broad, shallow troughs in the road surface that allow water to flow across the road and that can be driven over at reduced speeds by standard logging equipment. Rolling dips provide road surface drainage, and prevent a stream from diverting down a road when a culvert plugs. Rolling dips require periodic maintenance.

Erosion prevention: an aggressive program that treats potential sediment sources from roads to prevent major sediment impacts. Treatments include upgrading long-term roads to modern-day standards, and permanently or temporarily decommissioning them. On roads to be upgraded, rolling dips provide road surface drainage, and unstable fill along roads and landings is pulled back. Successful erosion prevention, on upgraded roads, relies on long-term road maintenance. On decommissioned roads, outsloping occurs only where the potential for landsliding had been identified during road inventories.

Extensive restoration: similar to erosion prevention, and also relies on long-term maintenance of roads. In contrast, however, upgraded roads are reshaped to eliminate inside road ditches and provide surface drainage. This method is used instead of rolling dips to control surface runoff from roads and inside ditches, and requires somewhat less maintenance. On decommissioned roads, all road areas between stream crossings are outsloped whether or not the potential for landsliding had been identified during road inventories.

Alternatives Considered for Detailed Analysis

A no-action alternative (Alternative A) and two action alternatives for preventing erosion on roads are considered. Two treatment options are analyzed as Alternative B (Erosion Prevention) and Alternative C (Extensive Restoration). Both action alternatives would reduce the known potential for erosion at stream crossings, landings and roads, and would treat about the same number of sites. However, under Alternative C all road areas between stream crossings on decommissioned roads would be outsloped, whether or not the potential for landsliding had been identified during road inventories. Alternative C would also reshape long sections of road to control surface runoff instead of using rolling dips as proposed under Alternative B. Table 1 provides a summary of Alternatives B and C.

The action alternatives would treat a total of 63,100 cubic yards of erosion potential on 28 miles of roads. Approximately 18 miles of roads would be treated on the SPI lands in Lake Prairie Creek which have a total erosion potential of 52,200 cubic yards. Of this, 35 stream crossings account for nearly 30,000 cubic yards and 14 potential landslide sites account for 20,000 cubic yards of erosion potential. Most crossings have diversion potentials and nearly all of the potential landslide sites are unstable log landings. About 10 miles of roads would be treated on Russ lands which have a total erosion potential of 12,900 cubic yards. Sixty-four stream crossings account for all of the erosion potential. Most of these crossings have diversion potentials with the ability to erode an undermined volume of sediment from hillslopes. Combining both proposed projects, approximately 19 miles of roads would be upgraded to modern-day road standards, 7 miles would be temporarily decommissioned, and 2 miles would be permanently decommissioned.

Table 1. Summary of Alternative B and Alternative C

Program Components	Alternative B Erosion Prevention	Alternative C Extensive Restoration
Treatments Common to Alternatives	Along upgraded roads, worn and undersized culverts are replaced with culverts sized for 50- to 100-year storms; rolling dips are placed at all stream crossings with diversion potentials; unstable fill along roads and landings is pulled back. On decommissioned roads, stream crossings are completely removed, and unstable areas would be outsloped.	
Treatments Unique to each Alternative	On upgraded roads, rolling dips provide long-term surface drainage. On decommissioned roads, deeply excavated surface drains provide long-term drainage; outsloping would occur only where the potential for landslide erosion had been identified during road inventories.	On upgraded roads, road surfaces are reshaped to eliminate inside ditches and provide long-term surface drainage. On permanently decommissioned roads, all sections of road between stream crossings would be outsloped, whether or not landslide potentials had been identified during road inventories.
Length of Program	Would be completed more quickly than Extensive Restoration (1-2 construction seasons).	Would be completed more slowly than Erosion Prevention (2-3 construction seasons).
Estimated # of Sites Treated	99 stream crossings 14 landslides 19 miles of road upgraded 7 miles temp. decommissioned 2 miles perm. decommissioned (about 0.5-mile outsloped) 66 culverts replaced 1 bridge rebuilt	Same as Alternative B 6 miles inside road ditches removed 2 miles perm. decommissioned (2 miles outsloped)
Cost	Less than Extensive Restoration.	At least $123,400 more than Erosion Prevention.

Alternative A: No Action

The no-action alternative is a continuation of current road management practices and a continuation of smaller erosion prevention projects on private lands. This alternative would not treat the erosion potentials on any road in the project areas. Road improvements would occur sporadically, whenever timber harvest plans are submitted for this area. It is unlikely that roads would be decommissioned. Of the 28 miles of road in the project areas, at least half of these roads are currently abandoned and unmaintained.

Items Common to Alternative B and Alternative C

Treatments: determining which sites to treat would be based on the erosion potential at each site and whether erosion, if it occurred, could reach a stream.

- On roads that would be upgraded, worn or undersized culverts at stream crossings would be replaced, culvert inlets on the larger stream crossings would be protected with rock, and all unstable fill along the outer edges of roads and landings would be pulled-back.
- Culverts would be sized for 50-year to 100-year storms, and rolling dips would be constructed at all stream crossings with diversion potentials on upgraded roads.
- On temporarily or permanently decommissioned roads, all fill that was originally placed in a stream crossing would be completely removed, and unstable areas that are prone to landsliding would be outsloped.
- One failing, log-stringer bridge would be replaced with a railroad flatcar bridge.

Heavy Equipment Work: all work would be done with bulldozers and hydraulic excavators.

- Heavy equipment work would occur only during the summer months when streams have reached summer low flows or are dry (June 1, 1998 - October 15, 1998). If projects are not completed during this time, work would resume the following year during the same period.
- Areas disturbed as a result of heavy equipment work would be limited to existing road corridors. No work is anticipated on hillside areas away from roads.
- Heavy equipment work would be closely supervised. Park geologists and staff from NRM and SPI would work with heavy equipment operators during the entire project.

Water Quality Considerations: standard erosion control measures would be taken to protect water quality during and after project implementation.

- If water is present at a stream crossing where a culvert is being removed or replaced, measures would be taken to minimize sedimentation to the stream. Such measures would include pumping streamflow around the crossing during work, or constructing sediment catch basins using fence posts or straw bales with filter fabric placed in the stream, immediately downstream of the work site.
- Bare soil areas created by heavy equipment would be treated to prevent sheet and rill erosion. At stream crossings, bare soil areas would be mulched with full length straw at a rate of at least 4000 lbs. per acre (2-3 inches thick). At landings or along roads, bare soil areas would be mulched with whole vegetation or woody debris that must be removed during treatment.

Alternative B: Erosion Prevention (Preferred Alternative)

Roads needed for long-term management would be upgraded to modern-day standards. Dead-end roads not needed in the immediate future would be temporarily decommissioned. Roads that cross highly unstable terrain would be permanently decommissioned. Figures 4-6 show the roads that would be treated.

On upgraded roads, rolling dips would be used to drain road surfaces and inside ditches. Depending on site conditions and the frequency of dips needed, about 600-1000 feet of road can be treated per hour. Where road surfaces had been previously rocked, the rock would be scraped from the road surface, pushed aside, then reapplied upon completion of a rolling dip. Unstable fill along the outer edges of roads and landings that could reach a stream if failure occurred, would be pulled back.

On roads that would be permanently or temporarily decommissioned, deeply excavated surface drains would be used to dissipate road and inside ditch runoff. They would be used only on stable road sections between stream crossings, where landslide potentials do not exist. About 900 feet of road can be treated per hour using this method. Decommissioned roads would also be outsloped. However, outsloping would occur only where the potential for landsliding had been identified during road inventories. Based on similar work in Redwood National Park, about 100 feet of road can be outsloped per hour, depending on site conditions.

Alternative C: Extensive Restoration

As under Alternative B, roads needed for long-term management would be upgraded to modern-day standards. Roads not needed in the immediate future would be temporarily decommissioned, and those crossing highly unstable terrain would be permanently decommissioned.

Along roads that would be upgraded, inside ditches would be permanently eliminated to provide long-term control of road surface drainage. This method would be used instead of rolling dips constructed at regular intervals, as proposed under Alternative B. Eliminating inside ditches would require roadbeds to be reshaped so that they slant outward, forcing surface runoff to shed across the road surface.

Inside road ditches could be eliminated only where road grades (steepness) are less than 10 percent, because of safety considerations. Road surfaces currently rocked for all weather use would be buried during the reshaping of roads, as the outside areas are lowered (digging below the rocked surface) and the inside areas are raised (burying the rocked surface). Rocked surfaces would have to be replaced following treatment. Treatment rates would vary depending on road conditions (width, steepness, and the amount of vegetation along outside edge of road), but are estimated to be one-half-mile per day.

On roads that would be permanently decommissioned, all intervening sections of roads between stream crossings would be outsloped whether or not landslide potentials had been identified during road inventories. In contrast and under Alternative B, outsloping would occur only where the potential for landsliding had been identified by road inventories.

Figure 4. Road Treatments in Lake Prairie Creek
Sierra-Pacific Industies Lands

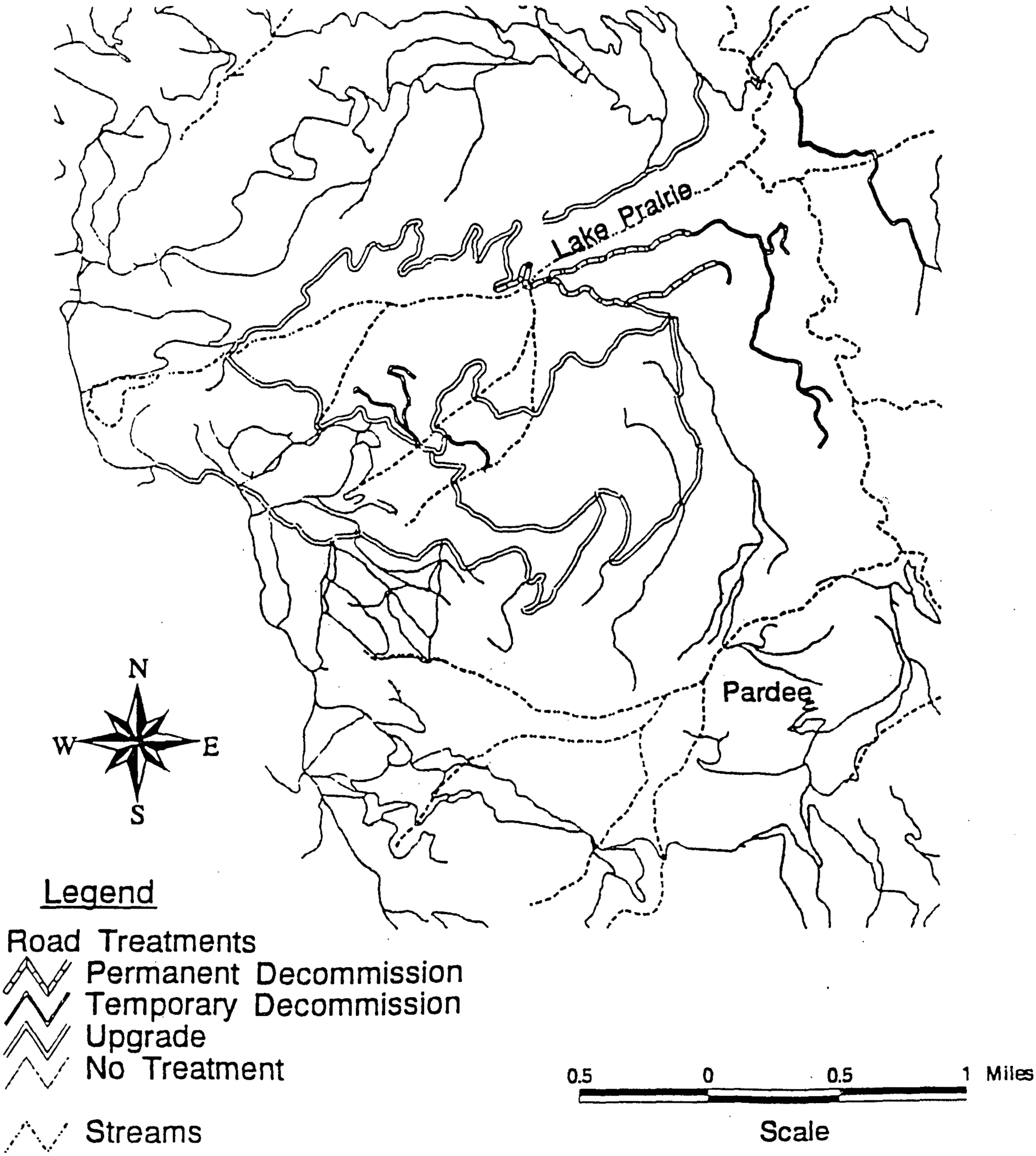


Figure 5. Road Treatments on Russ Lands (north-half)

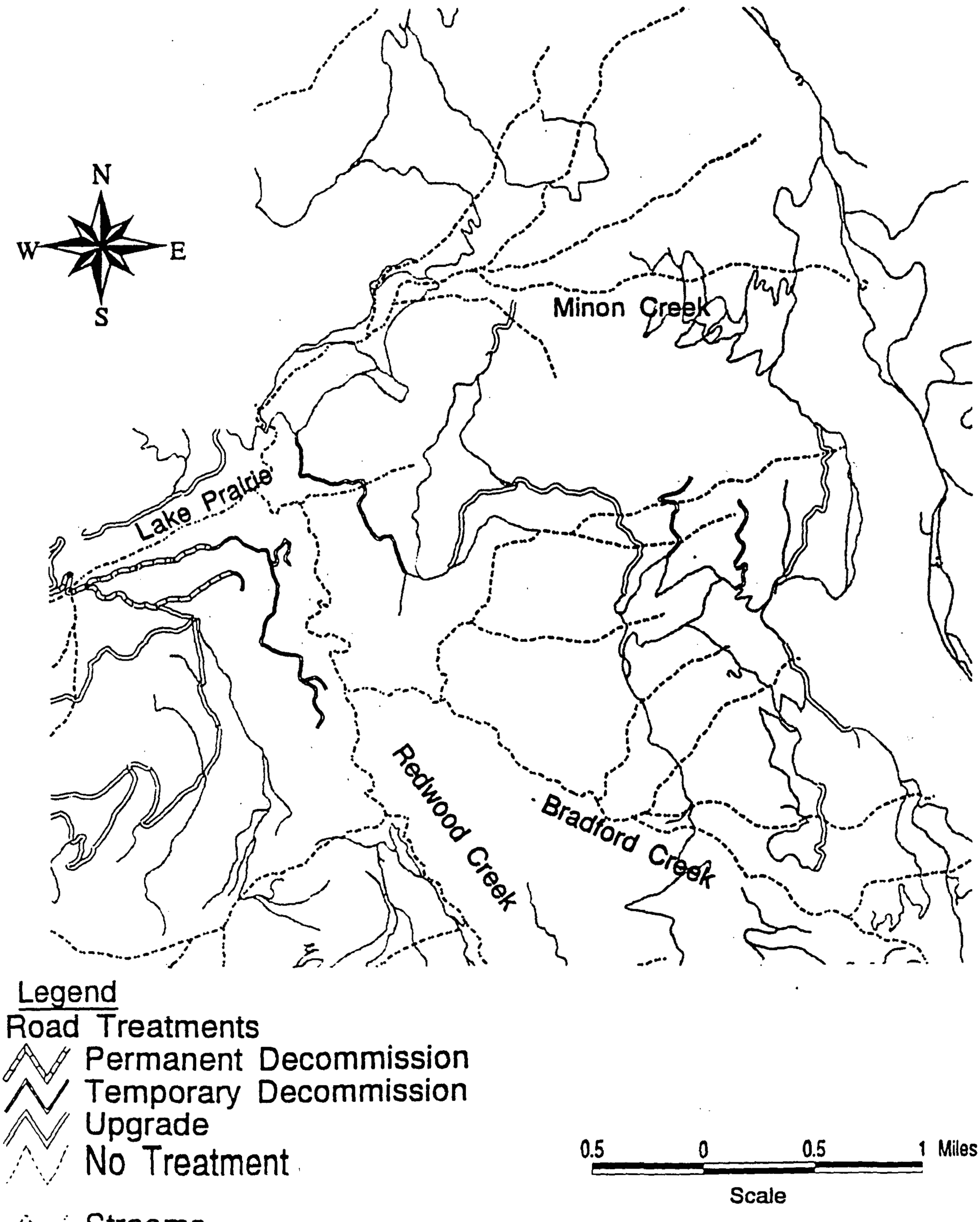
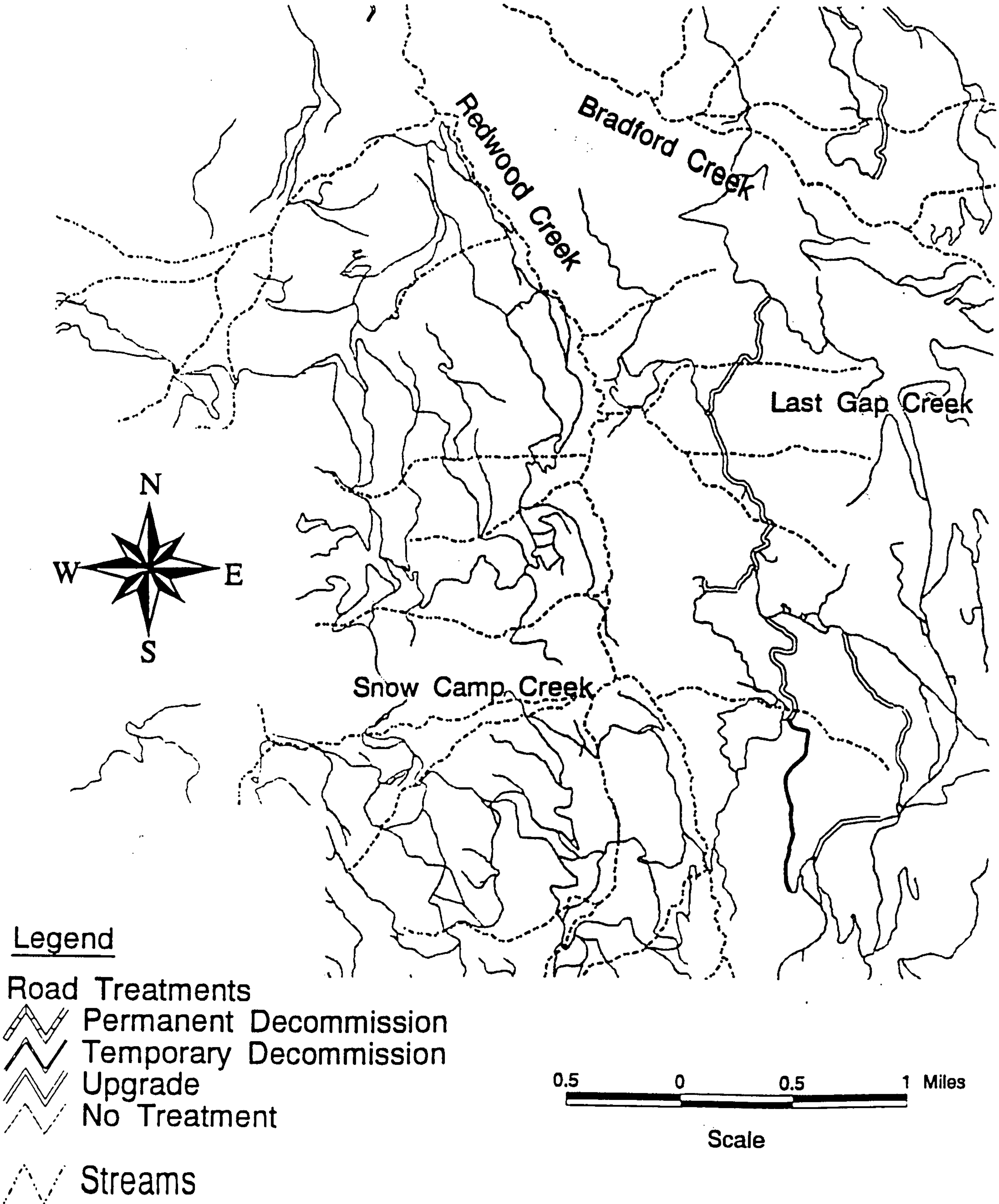


Figure 6. Road Treatments on Russ Lands (south-half)



AFFECTED ENVIRONMENT

Lands in the project areas are privately owned, commercial timber and ranch lands. Timber harvest began in the project areas during the late 1930's with the advent of crawler tractors, but harvests were limited to selective cutting methods. Intensive timber harvest using clearcutting methods began in the late 1940's, during a post-war period of increased demand for wood products with more advanced tractor technology (Best, 1995). Grazing has occurred since the late 1800's, following European settlement of these lands. Timber harvest and grazing will continue to be the primary use of these lands. Timber harvest activities are regulated by the State of California under the Z'berg Nejedley Forest Practice Act of 1973, as amended.

Most of the roads in the project areas were constructed before the state forest practice rules adopted modern-day road construction standards. The 18 miles of roads in the SPI project area were originally built as logging haul roads, and are typical of the larger roads found on industrial timberlands. In contrast, the 10 miles of roads in the Russ project area were originally built for ranch operations. These roads have a much smaller "footprint" because they conform better to local topography than their larger counterparts on industrial timberlands.

Air Quality and Climate

Air quality in the project areas is excellent with no major point sources of pollution. The primary source of pollution is smoke from occasional controlled burns conducted in the late spring and early fall, and dust from logging trucks associated with timber harvest activities.

The climate of the project areas is moderate with cool wet winters and warm dry summers. The mean annual basin-wide precipitation is 80 inches (Janda and others, 1975). Most precipitation falls as rain, although snow is common in the project areas above 1600 feet. Rapid snowmelt can increase streamflow peaks during rain-on-snow events, as occurred during the 1964 flood. Rainfall is seasonal, with most rain falling between November and April. The dry warm summers are broken occasionally with summer fog, but persistent fog is more common in the lower portions of the Redwood Creek basin.

Geology, Topography and Soils

The SPI and Russ project areas are separated by Redwood Creek which, for most of its length, follows the Grogan Fault (Janda and others, 1975; Harden and others, 1982). Rocks located along the fault tend to be particularly weak and are prone to landslide erosion. The Grogan Fault forms the boundary between the two major lithographic units of the Franciscan assemblage.

The SPI project area is underlain by the Schist of Redwood Creek, a metamorphic rock unit of the Franciscan assemblage. This schist is normally less prone to earthflow movement, but forested earthflows are found. Due to the presence of shrink-swell clays, soils developed on the schist tend to develop cracks that can lead to debris slides and debris torrents. This makes roads and landings constructed on steep slopes particularly prone to landslide erosion when road fill is placed on steep slopes. Deep colluvial soils are common on mid-hillslope positions. They have a low rock content and are prone to deep gully erosion, especially when subjected to streamflow from diverted streams.

The Russ project area is underlain by the sandstone units of the Franciscan assemblage. These units contain sandstone, mudstone, and minor associated conglomerate, greenstone, and chert (Cashman and others, 1995). These rocks were subdivided by Harden and others (1982) into the Coherent Unit of Lacks Creek and the Incoherent Unit of Coyote Creek.

The lower portions of the Russ project area are underlain by the Coherent Unit of Lacks Creek which contains rocks that are less fractured and sheared than the incoherent unit. It is characterized by terrain having steep slopes (>60%), sharp ridge crests, and narrow V-shaped tributary valleys. Debris slides and debris avalanches are the dominant erosional processes in this geologic unit.

The upper portions of the Russ project area are underlain by the Incoherent Unit of Coyote Creek. It is more fractured and sheared than the coherent unit, contains a higher mudstone to sandstone ratio, and its soils are bluish gray and higher in clay. It is characterized by a more subdued terrain, having a rolling landscape with less deeply incised streams. Earthflow processes and deep gully erosion are the dominant erosional processes in this unit, as are steamside debris slides along Redwood Creek and its tributary streams.

Water Resources

Streams within this project area are typical of streams found in upland areas. Most are lower-order, intermittent streams with relatively small (<30 acres) drainage areas. Stream channels are narrow (2-6 feet), and stream gradients are steep (>20 percent). The main stem channels of tributary streams are larger-order, perennial streams.

There are approximately 34 miles of perennial streams in both project areas, based on U.S. Geological Survey topographic maps. Lake Prairie Creek is the primary drainage in the SPI project area. It contains about 6 miles of perennial streams. The Russ project area contains about 28 miles of perennial streams, including Simon (3 miles), Minon (8 miles), Upper Panther (5 miles), and Bradford (7 miles) Creeks, and about 5 miles of smaller, unnamed streams.

Stream discharge for the 100-year flood (a flood that, on average, will occur at least once during a 100-year period, and has a 1% probability of occurring annually) has not been calculated for Redwood Creek or its tributaries in the project area. At Orick, roughly 40 miles downstream from the project areas near the mouth of Redwood Creek, the 100-year flood is estimated to be 65,280 cubic feet per second (cfs) (USGS, 1993). The highest flow estimated for Redwood Creek was 50,500 cfs on December 22, 1964 at Orick, and 16,400 cfs at the O'Kane Bridge gaging station located about 5 miles downstream of the project areas, below Highway 299 (Harden, 1995). The storm of January 1, 1997 was estimated to be a 11- to 12-year event (USGS, 1993). Stream discharges measured at Orick and O'Kane were 43,000 cfs and 6,400 cfs, respectively.

Erosion from roads during past large storms severely impacted streams in the project areas and throughout the Redwood Creek basin. Sediment eroded from roads caused channel filling and widening, streamside landsliding, and loss of riparian vegetation. These changes affected aquatic habitat by reducing channel substrate sizes, filling pools, reducing shade and large woody debris recruitment, increasing water temperature, and decreasing dissolved oxygen concentrations (NPS, 1997a). Similar effects occurred during the January 1997 storm, which impacted tributaries within the project area and the main stem of Redwood Creek. Madej and Ozaki (1996) documented how high influxes of sediment from hillslopes and stream channels can persist for decades. After more than 30 years, the effects of the 1964 flood are still impacting the main stem of Redwood Creek on parklands in the lower basin.

Floodplains, Wetlands and Riparian Areas
Project work would occur in upland areas of the Redwood Creek basin where steep topography results in well-drained slopes, and streams transport sediment as opposed to depositing it. Because of this, the steep, lower-order tributary streams in the project areas do not have well developed floodplains. The floodplains along the lower main stem channels of tributary streams and Redwood Creek are better developed, but are also narrow because of their high position in the drainage.

The headwaters of Lake Prairie Creek includes a lake that is about 17 acres in size. It has been associated with sag ponds formed along the Snow Camp Mountain Fault (Harden and others, 1982). There are two small ponds on Russ lands, one in the headwaters of Minon Creek, the other in the most northern area. No work is proposed in the vicinity of these features.

Vegetation
The SPI project area is dominated by second-growth conifer and hardwood forests. Scattered old growth Douglas-fir, left during earlier harvests, remain throughout the project area. The Russ property contains large expanses of grasslands (called "prairies" locally) and Oregon white oak woodlands. The majority of grasses are not native to California. Douglas-fir is the dominant conifer species. Tan oak and madrone are the dominant hardwood species in both project areas. Hardwood forests also include bay laurel, red alder, and bigleaf maple. White fir, red fir, and incense cedar occur in mixed evergreen forests at higher elevations in the Russ project area. Both project areas are outside the range of coast redwood.

Wildlife
Black bear, blacktail deer, coyotes, bobcats, mountain lion, and a variety of small mammals are common in the project areas. Common bird species include red-tailed hawks, great horned owls, Steller's jays, ravens, grouse and quail.

Riparian areas adjacent to streams and beneath forest canopies are suitable for frogs and salamanders. Northern red-legged frogs, foothill yellow-legged frogs, and Pacific giant salamanders are likely to exist in and adjacent to perennial tributary streams within the project areas. Anderson (NPS, 1994) reported tailed frogs in Lake Prairie Creek, near the confluence with Redwood Creek. Historic and current distribution of southern torrent and Del Norte salamanders based on museum records reviewed by Jennings and Hayes (1994) showed that these species have not as yet been identified in upper Redwood Creek. Records from past timber harvest plans for the project areas have reported these species were not found due to a lack of talus slopes and fast flowing streams. Western pond turtles are unlikely to occur in the project areas, because the narrow stream valleys have extensive forest canopy that do not provide basking habitat (D. Halligan, personal communication, 1998).

Threatened and Endangered Species

There are no state or federally listed, proposed, or candidate threatened or endangered plant species known to occur within the project areas. State and federally listed threatened and endangered species, species proposed for listing, and candidate animal species known to occur within the project areas are chinook and coho salmon, steelhead and coastal cutthroat trout, northern spotted owl, bald eagle, and American peregrine falcon. Marbled murrelets may occur in the project areas, but suitable habitat is very limited.

Fish

Various salmonid species are anadromous, meaning they use both fresh and salt water environments during their life cycle. Anadromous fish hatch in fresh water and migrate to the ocean where they grow and mature. Depending on the species, they reside in fresh water for up to four years before entering the sea. Upon maturity, anadromous fish return to fresh water habitats to spawn. Steelhead and cutthroat trout can return from the ocean to spawn more than once in their life cycle whereas most pacific coast salmon species die after spawning. All salmonids require cool, clean water to survive warm summers, and for egg growth and survival. In summer when stream water temperatures rise, these fish are found in cool pools or shaded areas. Fish require gravel with low amounts of fine sediment for spawning.

Research conducted since 1980 suggests that chinook salmon and steelhead trout populations in Redwood Creek basin have declined, and that cutthroat trout also exist at relatively low levels (D. Anderson, personal communication, 1998). The decrease of salmonid populations in the Redwood Creek basin is attributed to many factors (Ridenhour and Hofstra, 1994), including major flood events, intensive timber harvest and road construction, commercial ocean and sport fishing, drought conditions, loss of estuarine volume and poor water circulation due to the influence of the flood control levees, and summer breaching of the estuary sand berm. The combined effects of large storms and intensive timber harvest through the 1970's caused dramatic channel changes, including channel widening, filling, bank erosion, and loss of riparian vegetation. These events significantly degraded water quality and spawning habitat by reducing the number of deep rearing and holding pools, decreasing summer base flows, increasing water temperatures, and reducing the amount and future recruitment of large woody debris that provides instream cover for fish and habitat complexity.

Historically, Redwood Creek was well known for its salmon and steelhead runs and for the large size of fish (Van Kirk, 1994). From the earliest accounts (circa 1890) Redwood Creek was said to have supported a substantial salmonid fishery. Although coho (or silver) salmon, coastal cutthroat trout and steelhead trout were present, chinook (or king) salmon was the most sought after fish because of its size. Fifty-pound chinook salmon were common, and when the fish were entering Redwood Creek, people would come from miles around to harvest this resource.

Threatened, endangered and candidate fish species in Redwood Creek include:
Chinook Salmon (*Oncorhynchus tshawytscha*): Federally Proposed Threatened.
Chinook populations of Redwood Creek are within the Southern Oregon and Coastal California Evolutionarily Significant Unit (ESU). They were federally proposed for listing on March 9, 1998. Summer surveys completed in the project area during the early 1980's would not have encountered chinook if they used this portion of the watershed because in Redwood Creek, chinook juveniles migrate downstream to rear in the Redwood Creek estuary after emergence from the redds. The downstream migration would have occurred before the sampling period. However, there are two reports of chinook salmon presence in the upper basin. Ten years ago adult chinook were observed on main stem Redwood Creek at the "powerlines crossing" at a jam upstream of Bradford Creek. During the winter of 1997-98, a chinook carcass was found on Redwood Creek near Ayres Cabin by Joe Masai (M. Smith, personal communication, 1998). Ayres Cabin is located just downstream of the project areas.

Coastal Cutthroat Trout (*O. clarki*): Federal Candidate.
The status of cutthroat trout is being reviewed by the National Marine Fisheries Service because of concerns this species may be declining. Cutthroat trout have been found in High Prairie Creek (Brown, 1988; Anderson, 1988). They would most likely be present in the main stem of Redwood Creek upstream to the confluence of High Prairie and Redwood Creek.

Coho Salmon (*O. kisutch*): Federally Threatened.
Coho populations of Redwood Creek are included within the Southern Oregon/Northern California ESU. They were federally listed as threatened in 1997. Earlier surveys conducted by Redwood National Park staff did not find coho within the project areas, but juveniles have been observed during summer steelhead surveys downstream of where Highway 299 crosses Redwood Creek (M. Smith, personal communication, 1998).

Steelhead Trout (*O. mykiss*): Federal Candidate.
Redwood Creek populations are within the Northern California ESU. Based on 1980 surveys, steelhead trout occur within the project areas and are found in the main stem of Redwood Creek up to Snow Camp, Smokehouse, and Twin Lakes Creeks (Anderson, 1988; Brown, 1988). In September 1994, juvenile steelhead trout were sampled on Redwood Creek upstream of Lake Prairie Creek (NPS, 1994).

In September 1995, two adult summer steelhead were observed in Redwood Creek between Minon and Lake Prairie Creeks (Smith, 1995). Surveys on Redwood Creek during the summer of 1997 encountered 20 adult summer steelhead between Bradford Creek downstream to Chezem Road (M. Smith, personal communication, 1998). Summer steelhead populations in Redwood

Creek are severely depressed and marginally viable (Anderson, 1993).

The National Park Service supported research work in the summers of 1980 and 1981 that conducted general stream surveys of the Redwood Creek basin to describe and characterize the rearing habitat and distribution of juvenile salmonids (Anderson 1988, Brown 1988). Based on the results of this work, steelhead are only known to occur in the lower 0.2-mile of Simon, Snow Camp, Smoke House, and Twin Lake creeks. No fish were found while electrofishing above instream barriers in these creeks. Steelhead were found in the lower 0.8-mile of Bradford Creek and in the lower 0.7-mile of Panther Creek (distance measured from their confluence with Redwood Creek). Population density decreased with distance upstream. No fish were detected in Last Gasp Creek and fish had minimal access. Minon Creek had at least 0.5-mile of access, and an unknown length of accessible habitat was available upstream of the area surveyed. Lake Prairie Creek had 0.3-mile of accessible habitat. Salmonids were detected above the most upstream barrier. That population could be a resident population or the result of adult migration past the barrier during favorable flow conditions.

The barriers encountered during the 1980 and 1981 surveys frequently had trout above them. In the field, however, it is impossible to distinguish between anadromous and resident juvenile fish. Also, it is difficult to differentiate between cutthroat trout and steelhead trout when they are small (<100 mm fork length). It is unknown whether the original barriers still exist, have changed to allow passage, or new barriers have formed downstream of what was described in 1980 and 1981. In addition from year to year, the dynamic nature of barriers and the timing, duration, and size of migrational stream flows may create a window of opportunity during which adult fish can migrate above a barrier. As such, because the park does not survey every year and the problems in distinguishing between anadromous and resident juveniles, there are no data upon which to make a definite determination on whether or not steelhead are able to migrate above the identified barriers to spawn upstream. However, it is generally assumed that all trout in coastal streams are anadromous.

Critical Habitat Designations: critical habitat for the coho salmon within the Southern Oregon/Northern California Coast ESU was proposed for listing by National Marine Fisheries Service on November 25, 1997 (NMFS, 1997). Critical habitat for chinook salmon was proposed on March 9, 1998. The project areas are included within the proposed critical habitat designations.

Birds

Threatened and endangered species of birds known to occur, or are likely to use these areas of the Redwood Creek basin, include:

Bald eagle (*Haliaeetus leucocephalus*): Federally Threatened; State Endangered.

No known bald eagle nesting sites exist within a 2-mile radius of the project areas (R. Jurek, personal communication, 1998). Wintering bald eagles may move through the Upper Redwood Creek area and may use trees along the main stem creek to roost.

American peregrine falcon (*Falco peregrinus anatum*): Federally and State Endangered.
No known American peregrine falcon nesting sites exist within a 2-mile radius of the project areas (R. Jurek, personal communication, 1998). Cliffs or rock outcrops in the project area suitable for falcon nesting are not known and have not been identified, although falcons likely forage in the upper Redwood Creek basin.

Northern spotted owl (*Strix occidentalis caurina*): Federally Threatened.
Nesting, roosting, and foraging habitat for northern spotted owls (owls) exists within the project areas. Locations of owls have been reported from results of surveys conducted within the project areas and on adjacent property.

Owl survey results from 1996 and 1997 indicate one pair of nesting owls and a single male owl may be within 0.25-mile of project work sites (D. Embree, personal communication, 1998). The survey stations where these birds were previously detected will be revisited in 1998 to confirm their status before project work begins.

Marbled murrelet (*Brachyramphus marmoratus marmoratus*): Federally Threatened; State Endangered.
The project areas are at the eastern edge of Zone 1 for the marbled murrelet identified in the Record of Decision (USFS, BLM, 1994) for the Northwest Forest Plan. Zone 1 is described as a zone adjacent to marine areas in which the majority of marbled murrelet detections and nests are located. The project areas are also within Conservation Zone 4 according to the Final Marbled Murrelet Recovery Plan (USFWS, 1997). This zone is identified as the Siskiyou Coast Range Zone described as extending from North Bend, Coos County, Oregon south to the southern end of Humboldt County, California. Conservation Zone 4 extends inland a distance of 35 miles from the Pacific Ocean shoreline, and coincides with the Zone 1 boundary line described in the Northwest Forest Plan.

Within the project areas, most of the suitable nesting marbled murrelet habitat has been removed as a result of logging activities, but some residual patches of habitat remain. Three areas within 200 to 700 feet of project work sites contain suitable nesting habitat, but have not been surveyed.

Most of the remaining suitable habitat for marbled murrelets in upper Redwood Creek has not been surveyed except on lands managed by the U.S. Forest Service. The U.S. Forest Service has not detected marbled murrelets in upper Redwood Creek south of Highway 299 during their survey efforts the last two years (J. Hunter, personal communication, 1998).

Critical Habitat Designations: the U.S. Fish and Wildlife Service has designated critical habitat for the northern spotted owl and the marbled murrelet. The project areas do not contain critical habitat designations for these two species. Critical habitat has not been designated for the bald eagle or the American peregrine falcon.

Cultural Resources

Prehistoric/Ethnographic Resources: the project area is located in the territory of the Whilkut people. Although various anthropologists disagree about the boundaries of this territory, all researchers include the upper Redwood Creek basin within the Whilkut area (Kroeber, 1925; Baumhoff, 1958; Wallace, 1978). Unfortunately, little is known about this Athabaskan speaking group since they were essentially annihilated as a cultural group soon after the arrival of Europeans in northwest California. Most sources state that although Whilkut territory was relatively large, there were only approximately 500 people in the group. According to Wallace (1978) the Whilkut, like the Chilula who lived downstream on Redwood Creek, not only depended on anadromous fish, but also relied heavily on the plant and animal resources of the land, which they used seasonally. Villages recorded in Merriam's notes and documented in Baumhoff (1958) are noted along Redwood Creek, the Mad River and the North Fork of the Mad River. No settlements are recorded upslope of Redwood Creek, in the vicinity of the project area. Like other locations in northwest California with similar vegetation and topography, prehistoric sites are likely to be located along ridgelines, near springs, on mid-slope terraces and on creek or river terraces. Other variables important in prehistoric site locations include important food resources and ecotones such as those between prairies and oak woodlands.

Although the Whilkut no longer exist as a group, it is possible that there are members of the Hupa tribe, and possibly other adjacent tribes, who trace their ancestors to the project area and the upper Redwood Creek basin, or to other Whilkut areas. A similar situation exists for some members of the Hupa tribe, who have ties to the Chilula and lower Redwood Creek.

Historic Resources: the SPI project area is primarily composed of steep forested slopes in various stages of regrowth. Although ranching has and still occurs on adjacent prairies to the north and west, within the project area, the primary use has been timber harvesting. Like the Russ property, major logging did not began until the late 1940's and 1950's, with earlier logging occurring in more accessible areas elsewhere in northwest California. Currently, the SPI project area is in timber production.

According to Robert Kelley (personal communication, 1998), the Russ property was originally homesteaded during the mid- to late-1800's, with an initial use of livestock grazing, mainly for a summer range. As noted previously, intensive timber harvesting began in the late 1940's and early 1950's. Up to the 1970's, grazing was favored over forest management, and tree girdling and prescribed burns were implemented in order to increase grazing areas. Since the 1970's, however, these practices have been curtailed and grazing has been reduced. As a result of tree planting and increased tree survival, about 65% of the property is now in timber production.

In order to research the results of previous cultural resources inventories in the project area, a record search was conducted at the Northwest Information Center of the State of California Historical Resources Information System. A total of 24 studies and six cultural resources were identified within 0.5-mile of the project areas. Only a small portion of the project area is included in these studies which were conducted in conjunction with proposed timber harvest plans, and private and federal land exchanges. Of the six recorded cultural resources, all but one are prehistoric archeological sites; four of these are located on major or trending ridgelines, the other is located at the confluence of creeks. This conforms to the prehistoric site location prediction model described above. The sixth identified cultural resource is linear and consists of the remains of a power line which dates to the early part of this century. This site, CA-HUM-613H, is located in the southern portion of the Russ project area.

In summary, because the project area is generally located on steep, often forested slopes, and because archeological sites found in this area are usually situated on major and adjoining ridgelines, the cultural resources sensitivity of the project area can be described as low. In addition, historic structures, which do not follow the same locational model as archeological sites, are not located within the area of potential effect.

ENVIRONMENTAL CONSEQUENCES

In general, the greatest direct adverse impacts to soils, water quality, riparian areas, and indirect adverse impacts to fish in the project areas would occur under Alternative A (No Action), because very little erosion prevention work would occur. Roads would continue to degrade, fail, and supply damaging amounts of sediment directly to streams. In contrast, the potential for erosion from roads would be greatly reduced under both Alternative B and Alternative C. Both alternatives would improve water quality and habitat for aquatic organisms by reducing the volume of soil that could be eroded and deposited into stream channels. The greatest potential for beneficial impacts to soils, water quality and fish habitat would occur under Alternative C (Extensive Restoration), because certain sites would be treated more thoroughly under that alternative. However, the greater cost of Alternative C might outweigh the perceived benefits for landowners, who might choose not to implement the entire program.

In and of themselves, the proposed projects would not significantly reduce the potential threats to park resources from the extensive road network on private lands, upstream of the park. The proposed projects are a beginning to what will hopefully develop into a larger-scale, basin-wide erosion prevention program. Broad acceptance of erosion prevention measures, and basin-wide implementation of projects, such as these, could significantly benefit the various resources in the Redwood Creek basin, and reduce the threat to park resources from upstream land use. Thus, the greatest adverse and beneficial impacts to various resources from all alternatives would occur within and adjacent to the project areas. These impacts would lessen as distance downstream of the project areas increases. Table 2 (page 36) summarizes the impacts from all alternatives.

Impacts from Alternative A: No Action

Because very little erosion prevention work would occur, the greatest potential direct, and indirect, adverse impacts from erosion associated with extensive road networks upstream of the park would occur under this alternative. State forest practice rules do not require long-term road maintenance, and unmaintained roads are expected to fail during future large storms. As roads fail, damaging amounts of sediment would be delivered directly to streams.

Air Quality: there would be no short-term or long-term adverse impacts to air quality, because no project work would occur under this alternative.

Soils: adverse impacts would occur to soils and site productivity under the no-action alternative. Roads and landings would fail during large storms by landslide processes that would either bury or strip productive soils from hillside areas. Large-scale gully and landslide erosion, caused by stream diversions or eroded stream crossings, would erode productive streamside soils. Site productivity would be reduced where top soil is lost. A single landslide can strip top soil from 5 acres to 10 acres, or more, from hillslope and streamside areas.

Water Quality: adverse impacts to water quality would occur under this alternative. Preventable erosion from roads and landings would increase the amount of sediment transported and/or deposited in streams. Total sediment concentrations and stream turbidity would increase above natural levels during large storms, as road failures occurred. Based on the conservative estimates of erosion potential for 28 miles of roads in the project areas, at least 63,000 cubic yards of sediment would likely be deposited directly in streams as roads failed during future large storms.

Floodplains, Wetlands and Riparian Areas: adverse impact … reas along the main stem channels of tributary streams and Redwoo… ea, would result under this alternative. As roads fail during large s… ill rapidly with sediment, or would be lowered below their current … erosional processes. If channels filled, channel widening and s… follow. If channels lowered, the floodplain would become "dis… channel. In both cases, streamside trees and other vegetation, t… function and stability, would be lost. Similar impacts to the flc… ong Redwood Creek could result within the park boundaries, if a basin-wide erosion prevention program is not established on private lands upstream of the park.

$\frac{63{,}000 \text{ yd}^3}{6{,}000 \text{ Ac}} = 10.5 \text{ yd}^3/\text{Ac}$

Vegetation and Wildlife: there would be adverse impacts to vegetation from landsliding originating from roads (see Floodplains, Wetlands, Riparian Areas, above). Impacts to vegetation would cause impacts to wildlife if animal habitat, including large trees, were lost. Animals that inhabit or are dependant on this vegetation would be adversely affected because their habitat would be lost.

Threatened and Endangered Species: indirect, adverse impacts would occur to coho and chinook salmon, and steelhead and coastal cutthroat trout under this alternative. Impacts would result when large amounts of sediment enter streams from continued road failures, thereby reducing the quantity and quality of anadromous fish spawning and rearing habitat. Failures that cause soil to directly enter stream channels would have adverse impacts on fish species by: reducing the depth of pools used for refuge from high summer water temperatures; reducing the number of pools and simplifying habitat; filling spawning gravels with fine sediment, thus reducing survival of eggs, and; reducing stream depths, thus increasing the difficulty of travel and reducing the cover protecting fish from predation.

Indirect, adverse impacts might occur to northern spotted owls and marbled murrelets if large trees were lost by landslide processes associated with roads.

Cultural Resources: under this alternative, future adverse impacts to cultural resources from timber harvest plans should be minimized through the timber harvest plan review process. If projects are implemented which are not subject to review, there is the potential for future adverse effects to cultural resources.

Socio-Economic Impacts: job opportunities that were to be developed under the Northwest Forest Plan and the Redwood National Park expansion legislation would be lost under this alternative. A no-action alternative would be contrary to the park's enabling legislation that directs the National Park Service to protect park resources along Redwood Creek from upstream erosion. The opportunity to develop cooperative working relations with the landowners, who will always reside and operate in areas upstream of the park, would be lost.

Impacts Common to Alternative B and Alternative C

Air Quality: no long-term, significant adverse impacts to air quality are anticipated. Both alternatives would result in localized minor, temporary adverse impacts to air quality from dust particles and exhaust fumes from construction equipment at work sites.

Soils: there would be short- and long-term, indirect beneficial impacts to soils under both alternatives. The potential for large-scale erosion, associated with roads in the project areas, would be reduced. Preventing landslides from roads and landings would protect top soil and forest site productivity.

Minor, short-term, direct adverse impacts would occur under both alternatives from earth moving activities. Soils would be disturbed at stream crossings when installing or removing culverts, and along roads and landings when pulling back unstable fill. All soils that would be disturbed by project work were previously disturbed during original road construction, timber harvest or ranch activities. Thus, no significant adverse impacts to soil and site productivity are expected.

Water Quality: there would be short- and long-term beneficial impacts to water quality within the project areas. By upgrading the condition of roads, and permanently or temporarily decommissioning them, both alternatives would prevent at least 63,000 cubic yards of fine and coarse sediment from being deposited directly into streams during future large storms. Long-term benefits of reduced sedimentation would also result from continued road maintenance. Thus, these impacts would be beneficial within the project area, but would not provide significant benefits at the watershed scale, because of the extensive road network on private lands in need of similar work.

Properly sized and installed culverts would reduce the likelihood of stream crossing failures and stream diversions. Pulling back unstable fill along roads and landings would prevent landslide erosion and coarse sediment deposition in streams. Decommissioning roads would re-establish natural drainage patterns, eliminate future sediment sources, reduce road maintenance needs, and reduce the total miles of road within the Redwood Creek basin. These actions would provide long-term benefits to water quality of streams within the project area.

Short-term, direct, minor adverse impacts to water quality might occur if streams are flowing when crossings are being treated. Impacts would cause short-term increases in turbidity, lasting 4-6 hours, from soil disturbance at stream crossings when culverts are removed or replaced.

Short-term, indirect, minor adverse impacts might also occur from stream crossings removed on decommissioned roads. About 35 stream crossings would be removed under both alternatives. On average, about 5 cubic yards of sediment might erode from each freshly excavated stream channel during the first winter season. Sediment concentrations, immediately adjacent to the work sites might increase temporarily, but would decrease after the first large winter storm when the channels would adjust to their new form. Thus, no significant adverse impacts to water quality are expected, because the sediment volumes would be small and dispersed over a large area, and the expected erosion (<200 cubic yards) would be much less than the erosion potential of these crossings (15,000 cubic yards) if they were left in place or untreated.

Floodplains, Wetlands and Riparian Areas: there would be no adverse impacts to floodplains or wetlands under either alternative. No work is proposed in any wetlands, including those associated with the upland lakes and ponds.

There would be short- and long-term beneficial impacts to riparian areas, in the project areas, from both alternatives. Riparian areas would become more stable, because the potential for landslides, which can devastate these areas instantaneously, would be greatly reduced. Benefits of a stable riparian area include: maintenance of cool water temperatures needed by fish; stream channel and bank stability to maintain suitable habitat for fish and other aquatic organisms, and; nutrients for aquatic organisms and fish. Riparian vegetation: provides a source of large woody debris that maintains channel complexity required by fish for spawning and rearing; buffers water quality from pollutants, including sediment, entering a stream from runoff, and; provides stable environments for dependent species. Thus, these impacts would be beneficial within the project area, but would not be significant at the watershed scale, because of the extensive road network on private lands in need of similar work.

Under these alternatives, short-term, minor adverse impacts would occur to small riparian areas at stream crossings where culverts or bridges are treated. During culvert replacement or stream crossing removal, trees growing on the fillslopes (the filled area that is below the road) of a crossing would be removed. On average, about 450 square feet of surface area on the fillslopes would be affected, totaling about one acre over the entire project area. Trees growing on the fillslopes are usually alder and small (<12 inches in diameter) Douglas-fir. Conifer removal at stream crossings would be most common on older roads that would be decommissioned. Because these disturbances would be limited in size and spread over a large area, no significant impacts to riparian areas are expected.

Short-term, minor adverse impacts might occur to aquatic organisms and amphibians. If a stream is flowing during crossing removal, amphibians and aquatic organisms might be affected by short periods of increased turbidity. A slight increase in coarse sediment, during the first winter season, might also temporarily decrease habitat quality for frogs and salamanders. However, restored stream channels would eventually increase the amount and quality of habitat for amphibians, reptiles and aquatic organisms within the project areas, because of improved water quality and channel stability. The effects from removing stream crossings on aquatic invertebrates have been studied in Redwood National Park. Harrington (1982) found no adverse impacts occurred to invertebrate populations when stream crossings were removed during summer low flows. Given the measures that would be used to protect water quality during and following project work (refer to Water Quality Considerations under Alternatives), no significant adverse impacts to these resources are expected.

Replacement of culverts or bridges might require a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act, and a 1603 Agreement with the California Department of Fish and Game.

Vegetation and Wildlife: there would be no long-term adverse impacts to vegetation under either alternative. There would be short-term impacts to vegetation from earthmoving activities under both action alternatives. Impacts would occur to understory shrubs, hardwoods (tan oak, madrone, maple, alder) and small Douglas-fir (<12 inches in diameter). No large trees would be removed by project work under either alternative. Impacts would be limited to small areas immediately surrounding work sites and would be dispersed over a large area. The vegetation in these areas has been previously disturbed by the original road construction, commercial timber harvest, and large-scale erosional processes such as landsliding. Thus, there would be no long-term significant impacts to vegetation under these alternatives.

There would be no long-term adverse impacts to wildlife populations. Both action alternatives might result in short-term impacts caused by removing vegetation at work sites. Short-term impacts might also include localized noise and disturbance to wildlife. Under both alternatives, noise from heavy equipment might cause wildlife to leave the area around the work sites during the daytime when project work occurs. However, heavy equipment would move between different work sites fairly rapidly, and would not remain in the same area for extended periods of time. Vegetation removed by heavy equipment would also reestablish quickly. Vegetation adjacent to roads does not provide high quality wildlife habitat. Thus, no significant adverse impacts to wildlife are expected.

Indirect, minor beneficial impact would occur to wildlife species. Vehicle traffic would decrease or be nonexistent in areas where roads would be decommissioned. In these areas, deaths to wildlife due to vehicle collisions might decrease, and deaths due to predation might also decrease as vegetation grows and provides less exposure to some species as they move across areas that previously were roads.

Threatened and Endangered Species: no long-term, adverse impacts to chinook and coho salmon, or steelhead and cutthroat trout would occur under either action alternative. All work would be conducted between June 1 and October 15 when streamflow is low and spawning migrations are unlikely to occur. The National Marine Fisheries Service may allow work to be extended beyond October 15, if streamflow remains low and spawning migrations have not begun. Sediment impacts from work conducted at stream crossings would be minimized (refer to Water Quality Considerations under Alternatives). Under both action alternatives, project work would not occur near or along fish-bearing portions of streams. Thus, no significant adverse impacts to chinook and coho salmon, or steelhead and cutthroat trout are expected.

Indirect, beneficial impacts would occur to chinook salmon, and steelhead and cutthroat trout under both alternatives. The recurring loss of salmonid habitat from upslope erosion from roads would be reduced. Habitat quality, especially during summer low flows, would improve in the tributary streams and along Redwood Creek within the project areas. Thus, the survival of juvenile fish that reside in these fresh water habitats before migrating to the sea, should increase. While these benefits would be beneficial at the project level, they would not be significant at the watershed level, because of the extensive road network on private lands in need of similar work.

No adverse impacts to terrestrial threatened or endangered species, including northern spotted owls or marbled murrelets, would occur under either action alternative. Noise generated during project work may disturb nesting pairs of owls if their nests are located within 0.25-mile of work sites where heavy equipment would be used. Project work would begin after July 9 in these circumstances. Project work would also begin after July 9 where owl survey information is unavailable for suitable habitat that is within 0.25-mile from work sites. Owl nest locations are known to occur at distances greater than 0.25-mile from project work sites, but noise generated from heavy equipment would not be expected to disturb nesting owls at that distance. Thus, no significant adverse impacts to northern spotted owls or marbled murrelets are expected.

During the owl breeding season (February 1 - July 31) project work may begin in locations where noise levels from heavy equipment approximates ambient noise levels generated from vehicle traffic on the road (frequent or regular use). Project work might also begin during the breeding season in areas where survey information indicates that owls are nesting at distances greater than 0.25-mile from work sites.

Three areas have been identified as suitable marbled murrelet habitat, but these areas have not been surveyed. Noise generated from heavy equipment use might disturb nesting marbled murrelets if they are present within portions of these areas closest to project work sites. Project work adjacent to these locations would occur after the breeding season which ends September 15.

Indirect, minor beneficial impacts would occur to northern spotted owls and marbled murrelets under both alternatives. Large trees within the riparian area that might provide habitat for northern spotted owls and marbled murrelets would be less likely to suffer damage or be lost as a result of landsliding caused by road failures. Additional benefits would occur as noise disturbance and other activities associated with road use decrease in areas where roads would be permanently or temporarily decommissioned.

Cultural Resources: there would be no effect on cultural resources eligible for listing in the National Register of Historic Places from either Alternative B or Alternative C. Specifically, there would be no impacts to historic site CA-HUM-613H. It should be noted, however, there is a remote possibility that buried cultural resources will be encountered during project implementation. Should this situation occur, all work in the discovery area would stop and consultation with the National Park Service Archeologist would occur.

A Programmatic Agreement (PA) among the USFWS Region 1, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer (SHPO), regarding the Administration of Routine Undertakings in the State of California, was signed in March 1997. Through the administration of this PA, the USFWS would satisfy its National Historic Preservation Act responsibilities for routine undertakings. Section III. A. 1. and 2. state:

> Appendix A contains a list of those undertakings which by definition would be considered undertakings, but would have negligible potential to affect historic properties, and therefore do not require a field inspection, monitoring, or other form of cultural resource identification, and do not require consultation with the SHPO except for that called for in Stipulation IV.
>
> Appendix B contains a list of those undertakings which, by definition, would also be considered undertakings, but given their limited potential to affect historic properties, case by case review and consultation with the SHPO are not necessary. A specialist may determine the level of inspection, monitoring, or other identification as necessary in consultation with the SHPO.

Stipulation IV of the PA calls for annual reports to SHPO by the USFWS, that describe actions pursuant to the PA including those listed in its Appendices A and B. Included in the list of undertakings in Appendix A is: 7. A. "Maintenance within the existing road profile, such as grading, cleaning inboard ditches, repairing, brushing or replacing culverts, guards, and gates." and 7. B. "Decompacting (ripping), water barring, and out-sloping non-native road surfaces." Included in the list of undertakings in Appendix B is: 4. "Decompacting (ripping), water barring, and out-sloping native road surfaces."

The specific actions under the three Alternatives are described above. In addition, under Alternatives, Items Common to Alternative B and Alternative C it is stated that, "Areas disturbed as a result of heavy equipment work would be limited to existing road corridors. No work is anticipated on hillside areas away from roads." Based on this, and on the list of actions in Appendix A and B, it is determined that Compliance with Section 106 of the NHPA for the proposed project can be considered under the PA described above.

The majority of actions proposed are included under Appendix A, 7. A. and 7. B. of the PA; these projects, under the terms of the PA, do not require a cultural resources identification effort (36CFR800.4). A small percentage of the projects are included in Appendix B, 4. As stated in the PA, these undertakings will be subject to a cultural resource identification effort. In order to ensure the protection of cultural resources, all proposed project areas will be subjected to a field check by the National Park Service Archeologist, before ground disturbance. In accordance with the PA, if no historic properties are found within the Area of Potential Effect of the undertaking, the project will proceed without further consultation. If cultural resources, which may qualify for the National Register of Historic Places, are identified, the project will be modified so that the undertaking will have "no effect" on the cultural resources. In addition, the steps outlined in the PA in Section III. A. 4. a., b., and c. will be followed.

Due to the routine nature of the undertaking, that is, road maintenance and decommissioning, and because the likelihood of prehistoric or ethnographic sites occurring in the project area is low, consultations with Native Americans who have traditional associations with the project area, are not planned for the proposed project. However, if, during the course of the field check of the project area by the National Park Service Archeologist, significant prehistoric or ethnographic cultural resources were identified within the project area, consultations with appropriate Native Americans would then be undertaken.

Socio-Economic Impacts: employment and training opportunities would increase under both action alternatives. Although beneficial, the impacts to employment and training opportunities would not be significant, because these projects would be limited in scope and duration. However, successful completion of this project would demonstrate that multiple government agencies and private industry can cooperate to reach a common goal. Cooperative erosion prevention projects, such as these, would encourage broader landowner participation and watershed-wide efforts to prevent erosion from roads in the Redwood Creek basin.

<u>Impacts from Alternative B: Erosion Prevention</u>

This alternative would reduce the potential for erosion at stream crossings, and along roads and landings by upgrading roads, and permanently or temporarily decommissioning them. Reducing the potential for erosion would have direct and indirect, short- and long-term beneficial impacts to the various resources in the project areas, but would have little effect on the downstream resources within the park. This alternative might result in slightly less benefit to the resources than under Alternative C, but when compared to the no-action alternative, Alternative B would substantially reduce the threat to aquatic and riparian resources from road associated erosion. It would also cost less than Alternative C and, therefore, would be more likely to be implemented by private landowners.

Soils: there would be short- and long-term, indirect beneficial impacts to soils and site productivity in the project areas under this alternative (see Impacts Common to Alternative B and Alternative C). Long-term, adverse impacts might result in reduced site productivity, if the potential for landsliding had not been identified during inventories of permanently decommissioned roads. Because the potential for future landsliding would be low (refer to following discussion), significant adverse impacts to soils are not expected.

Water Quality: there would be short- and long-term, direct and indirect beneficial impacts to water quality under this alternative (see Impacts Common to Alternative B and Alternative C).

Long-term, indirect adverse impacts might result under this alternative. Impacts would be surface erosion of fine sediments from roads and inside ditches, if rolling dips are not maintained. In contrast to Alternative C, rolling dips would provide long-term surface drainage of roads and inside ditches. Although rolling dips are considered "permanent" drainage structures, they require periodic maintenance. However, the landowners have agreed to maintain all improvements that result from these projects for at least 10 years. Also, future advances in state forest practice regulations are likely to stress long-term road maintanence. Therefore, it is likely that rolling dips would be maintained. Thus, no significant adverse impacts to water quality are expected under this alternative.

Long-term, indirect adverse impacts might also include increased deposition of coarse sediment in streams from landslide erosion, if the potential for landsliding had not been identified along permanently decommissioned roads. In contrast to Alternative C, all of the intervening road sections between stream crossings would not be outsloped. Instead, outsloping would occur only where the potential for landsliding had been identified during road inventories. While future landsliding would be possible, it would also be unlikely. The attributes of potentially unstable roads (steep slopes, sheared or highly weathered bedrock and/or soils, emergent groundwater) are well documented and discernable in the field. Therefore, it is highly unlikely that a potential landslide, capable of delivering large volumes of sediment to streams, would be overlooked during road inventories. Thus, if future landslides occur from permanently decommissioned roads, significant impacts to water quality are not expected, because these failures would either be small or would not reach a stream.

Floodplains, Wetlands and Riparian Areas: there would be short- and long-term beneficial impacts to riparian areas under this alternative (see Impacts Common to Alternative B and Alternative C). Long-term, indirect adverse impacts might result in loss of riparian areas from landslide erosion, if the potential for landsliding had not been identified along permanently decommissioned roads. However, future landsliding from permanently decommissioned roads is unlikely and, if failures occur, they would be small or would not deliver sediment to streams. Thus, no significant adverse impacts to floodplains, wetlands and riparian areas are expected.

Vegetation and Wildlife: minor, direct adverse impacts would occur to vegetation. Under this alternative, about four acres of vegetation would be temporarily lost throughout the project areas where roads are outsloped and stream crossings are treated. Vegetation disturbance would be spread over a large area, because only landslide-prone areas would be outsloped, and stream crossings are often separated by hundreds, if not thousands of feet. Also, the vegetation that would be removed is not high quality wildlife habitat. Thus, no significant impacts are expected.

Threatened and Endangered Species: impacts to threatened and endangered species would be the same under both action alternatives. Refer to Impacts Common to Alternative B and Alternative C.

Socio-Economic Impacts: beneficial economic impacts would occur under this alternative. Costs associated with road maintenance and the need for reconstruction after failure would be reduced. There would be no additional rock costs on upgraded roads when rolling dips are used to control road surface drainage. Deeply excavated cross-drains, on decommissioned roads, are cost-effective where landslide potentials do not exist.

Impacts from Alternative C: Extensive Restoration

This alternative might result in the greatest benefit to resources, but the cost would be the highest of any alternative; thus, it would be less likely to be implemented. This alternative would treat decommissioned and upgraded roads more thoroughly than the proposed action. All intervening road sections between stream crossings would be outsloped on permanently decommissioned roads, whether or not landslide potentials exist. About one-third of the inside ditches would be removed along upgraded roads.

Soils: the greatest short-term adverse impacts to soils would occur under this alternative, because more roads would be disturbed when eliminating inside ditches, and more roads would be outsloped on permanently decommissioned roads. About 6 miles of road surfaces would be reshaped to disperse surface runoff from roads and eliminate inside ditches. On permanently decommissioned roads, outsloping would occur on about 1.5 miles more road than under Alternative B. Since these areas have been previously disturbed by road construction, no significant impacts to soils are expected.

The greatest long-term, indirect benefits to soil resources and site productivity would occur under this alternative, because all intervening road areas between stream crossings, on permanently decommissioned roads, would be outsloped. By doing so, the landslide potential might be reduced more than under Alternative B, if potential landslides had not been identified during road inventories. However, as explained previously, the likelihood of overlooking a potential landslide would be low. Thus, the benefits to soils and site productivity from this alternative would not be significant on either a project or watershed level.

Water Quality: this alternative could potentially provide the greatest short- and long-term benefits to water quality. Eliminating inside road ditches near stream crossings would reduce the amount of fine sediment delivered to streams from roads and inside ditches. Sediment reductions would occur because roads and inside ditches would no longer drain directly into stream crossings. However, rolling dips, as proposed under Alternative B, also are effective at preventing sediment from reaching streams, but rolling dips require periodic maintenance. Also, the amount of sediment reduction from this treatment is probably much less than from other types of treatments at stream crossings, and at unstable roads and landings. Thus, the benefits to water quality would be minor.

Short- and long-term beneficial impacts to water quality might also result from outsloping all road sections on permanently decommissioned roads. By doing so, the landslide potential might be reduced more than under Alternative B, under which outsloping would occur only if potential landslides had been identified during road inventories. However, the likelihood of overlooking a large potential landslide during a road inventory would be low. Thus, the benefits to water quality from this alternative would probably be minor on a project and watershed level.

Short-term, direct, minor adverse impacts to water quality would be somewhat higher than those under Alternative B because more soil would be disturbed when roads are reshaped, and more roads would be outsloped. Continuous soil disturbance on reshaped roads could range from 200 feet to 300 feet. However, roadside areas would contain vegetation that would trap and filter sediment from freshly reshaped road surfaces. Outslope treatments on permanently decommissioned roads would extend continuously for about 2 miles. However, bare soil areas would be mulched by whole vegetation that must be removed during the road treatment. Thus, significant adverse impacts to water quality are not expected.

Floodplains, Wetlands and Riparian Areas: this alternative would result in the greatest benefit to riparian areas because, by default, all potential landslides along permanently decommissioned roads would be treated. If potential landslide areas had been overlooked during road inventories, these landslide would not occur because all roads would be outsloped. Thus, there would be fewer large and sudden inputs of sediment to streams that can damage streamside areas, instantaneously.

Minor, short-term adverse impacts to small, riparian areas at stream crossings would be similar to those of Alternative B. Minor, short-term impacts to stream channels and aquatic organisms from project work also would be the same as under Alternative B.

Vegetation and Wildlife: minor, direct adverse impacts would occur to vegetation growing along the outside edge of a road to be permanently decommissioned. The type of impacts would be similar as under Alternative B, but they would occur on a larger area. Under this alternative, about 10 acres of vegetation would be temporarily lost from road outsloping and stream crossing treatments throughout the project areas. Removal of vegetation would cause a short-term loss of vegetative cover, and might impact some wildlife species using those areas for nesting, foraging and reproduction. Because these impacts would be dispersed over a large area, and much of this vegetation has been previously disturbed by past timber harvest activities, no significant adverse impacts to vegetation and wildlife are expected.

Long-term beneficial impacts to wildlife might be greater than under Alternative B, because all intervening road areas between stream crossings on permanently decommissioned roads would be outsloped. Habitat fragmentation would be reduced over time, and opportunities for natural recruitment of vegetative cover, over a larger area, might also improve.

Threatened and Endangered Species: the indirect, beneficial impacts from this alternative are similar to those under Alternative B. However, since all intervening road areas between stream crossings on permanently decommissioned roads would be outsloped, the continued loss of salmonid habitat from upslope erosion might be reduced more under this alternative. The impacts from fine sediment to fish habitat might also be reduced more under this alternative, because reshaping roads, to eliminate inside ditches, would reduce the amount of fine sediment reaching streams.

Socio-Economic Impacts: because this alternative would be the most expensive, it represents a potential, long-term, adverse impact to implementing a basin-wide erosion prevention program. Work that utilizes earthmoving equipment is expensive. Landowners and government agencies have limited funds for such work. The higher costs associated with this alternative would most likely not be balanced by proportionately higher sediment reductions. Thus, the overall cost-effectiveness of the projects would be reduced, which might discourage landowner acceptance of such efforts.

Under this alternative, reshaping road surfaces to eliminate inside ditches on upgraded roads would cost about $16,000 per mile, including rock. Project costs would increase by about $100,000, assuming the inside ditches along one-third of the upgraded roads were removed. The amount of erosion that would be prevented from this treatment is difficult to estimate, but it would prevent substantially less erosion than other types of treatments at stream crossings and along unstable roads and landings.

About 2 miles of permanently decommissioned roads would be outsloped, as compared to 0.5-mile under Alternative B. Since outsloping costs about $13,000-$18,000 per mile, or more, depending on road conditions, project costs would increase by at least $25,000. This increase would be offset by about $1600, because the deeply excavated cross-drains in Alternative B, would not be needed where outsloping occurs. Thus, the total project costs under this alternative, would be at least $123,400 more than under Alternative B.

Table 2. Summary of Impacts

Resource	Alternative A No Action	Alternative B Erosion Prevention	Alternative C Extensive Restoration
Air Quality	no impact	minor dust and exhaust from vehicles and heavy equipment	same as Alternative B
Soil	continued loss of hillside and streamside top soils as landslides and crossing failures occur from roads	increased protection for top soil and site productivity from reduced potential of large-scale erosion from roads	potentially greater benefits for project areas than Alternative B because, on permanently decommissioned roads, all road areas between stream crossings would be outsloped whether or not the potential for landsliding had been identified during inventories
Water Quality	increased fine and coarse sediment, and turbidity as roads fail during large storms	potential erosion from roads reduced by at least 63,000 cubic yards	same as above for Soil
Floodplains, Wetlands and Riparian Areas	continued damage to riparian areas and streams within project areas; continued threat to park resources from upstream erosion	increased stability of riparian areas and streams within project area; somewhat reduced threat to park resources from upstream erosion	same as above for Soil; provides the same benefit for park resources as Alternative B
Vegetation and Wildlife	continued loss of hillside and streamside vegetation as landslides occur from roads	1 acre of hardwoods and small conifers removed at stream crossings; 3 acres removed during road outsloping	1 acre of hardwoods and small conifers removed at stream crossings; 9 acres removed during road outsloping
Threatened and Endangered Species	continued loss of salmonid habitat in project area streams and Redwood Creek; no impacts to bald eagle, peregrine falcon, or spotted owl	improved salmonid habitat in project area and Redwood Creek; no impacts to bald eagle and peregrine falcon; no adverse impacts to northern spotted owl and marbled murrelet	potentially greater benefits than Alternative B because all roads would be outsloped on permanently decommissioned roads; no impacts to bald eagle and peregrine falcon; no adverse impacts to northern spotted owl and marbled murrelet
Cultural Resources	no effect	no effect; project areas would be surveyed before ground disturbance and cultural resources shall be avoided; remote chance that buried resources would be affected	same as Alternative B
Socio-Economic	lost opportunities to form partnerships with private landowners	provides training and employment opportunities; treatments (costs) are based on known erosional threats, having the greatest cost-effectiveness	provides training and employment opportunities; project costs would increase by at least $123,400 with potentially the same sediment reduction as Alternative B

Cumulative Effects

The proposed action represents a small part of a larger effort to prevent sediment impacts to the aquatic and riparian resources within Redwood National Park and its adjacent watersheds. Since 1981, the park has treated nearly 200 miles of former logging roads in the Redwood Creek basin, within the park boundaries. A General Management Plan, accompanied by an environmental impact statement, is currently being prepared to cover the park resources management programs, including watershed restoration within and upstream of the park. The park will also update its 1981 Watershed Rehabilitation Plan (NPS, 1981) to reflect new erosion prevention techniques developed over the past decade, and to describe specific areas that would be treated.

Erosion prevention projects have been implemented on small areas of private lands during the past few years. These projects have treated about 16 miles of roads in the Coyote and Garrett Creek basins. This proposal would treat erosional problems on an additional 28 miles of roads. Following completion of this proposed action, over 1000 miles of roads would remain in need of similar treatments. While forest practices have improved in recent year, current state forest practice regulations do not require long-term road maintenance. Therefore, continued adverse impacts to aquatic and riparian resources are anticipated, within and upstream of the park, from the extensive road network on private lands.

Redwood National Park's future watershed restoration program would reduce erosion from logging roads and sediment impacts in Redwood Creek and its tributaries. This is expected to result in significant, long-term benefits to the aquatic and riparian resources of the park. Since the park occupies only the lower-third of the Redwood Creek basin, the success of this effort will depend on the cooperation and participation of upstream landowners.

COMPLIANCE

Compliance with the following laws, regulations, and executive orders has been initiated and will be completed prior to project work.

Endangered Species Act of 1973, as amended

Consultation under Section 7 of the Act has been initiated with the U.S. Fish and Wildlife Service's Coastal California Fish and Wildlife Office and with the Eureka field office of the National Marine Fisheries Service. A biological assessment is being prepared describing the potential effects of the proposed project on northern spotted owls, marbled murrelets, coho salmon, species proposed for listing and species identified as candidates for listing. These agencies will issue biological opinions of the effects of the project on listed species. Based on the consultations and biological opinions, any measures to avoid, reduce or otherwise mitigate effects on listed species will be incorporated into the project specifications.

Clean Water Act

The Eureka Field Office of the U.S. Army Corps of Engineers has been contacted regarding the need for permits under Section 404 of the Clean Water Act. The cooperators have applied for the Department of the Army Nationwide Permit 27 which is needed for the replacement of some culverts and one bridge. The National Park Service would also obtain certification, or a waiver thereof, under Section 401 of the Clean Water Act from the California Regional Water Quality Control Board, North Coast Region.

California Fish and Game Code

The National Park Service or Natural Resources Management Corporation will enter into agreements with the California Department of Fish and Game under Section 1603 of the Fish and Game Code for any project work that will substantially divert or obstruct the natural flow or, substantially change the bed, channel, or bank, or use material from the streambed of any permanent stream. Some bridge and culvert replacements may require streambed alteration agreements (1603 Agreements) in addition to Section 404 permits.

National Historic Preservation Act of 1966

Compliance with Section 106 of the National Historic Preservation Act has been initiated under the 1997 Programmatic Agreement among the U.S. Fish and Wildlife Service, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer. Although no known cultural resources would be affected by the projects, the project areas will be surveyed by the National Park Service archeologist prior to ground disturbance, and the project modified if any cultural resources are found that may qualify for inclusion in the National Register of Historic Places. A complete description of potential project impacts and how such impacts would be mitigated is included in Impacts Common to Alternative B and Alternative C.

Executive Order 11988, "Floodplain Management", and Executive Order 11990, "Protection of Wetlands"

The National Park Service has determined that project work is not within the regulatory floodplain, nor are any actions proposed that are subject to compliance with the National Park Service Floodplain Management Guideline. Proposed actions are exempt from the requirements of the National Park Service Wetlands Protection Guidelines, because the projects involve maintenance, repair, or renovation of existing structures, and would restore hydrologic functions of some intermittent and perennial stream channels.

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