

Redwood

National Park

National Park Service
US Department of the Interior



Redwood National Park Fire Management Plan Environmental Assessment

Redwood National Park
Del Norte and Humboldt Counties, California
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Redwood National Park 2010 Fire Management Plan Environmental Assessment

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Redwood National Park 2010 Fire Management Plan Environmental Assessment

INTRODUCTION

This environmental assessment (EA) describes proposed actions in the 2010 draft Fire Management Plan (FMP) for managing fire and achieving fire management goals in Redwood National Park. The 2010 draft FMP is an update to the current approved 2005 FMP and proposes new projects that are similar to those in the current FMP, such as additional prescribed burn units and shaded fuel breaks. Most of the projects described in the draft 2010 FMP are completions or expansions of projects begun under the 2005 FMP. There are no new types of projects. This EA also describes alternatives to the proposed action with respect to natural and cultural resource management and protection; describes the environment including park natural and cultural resources in and around the parks that could be affected by fire; and analyzes the effects on the park environment of fire management activities under the proposed action and alternatives.

The draft FMP provides operational details and includes examples of documentation associated with on-the-ground planning and implementation needed to manage fire under federal and NPS regulations, policies, and guidelines, such as plans for individual prescribed burn plans and safety and staffing requirements.

Following public review of the plan and EA, the National Park Service (NPS) will select one of the alternatives as its final proposal for managing fire in the park. The selected alternative will become the final plan for fire management in Redwood National Park for five years from 2010 through 2015.

Background

Redwood National Park was established by Congress in 1968 “to preserve significant examples of the primeval coastal redwood (*Sequoia sempervirens*) forests and the streams and seashores with which they are associated, for purposes of public inspiration, enjoyment, and scientific study” [Public Law 90-245, Section 3(e)] The park was expanded in 1978 to “protect existing irreplaceable ... resources from damaging up slope and upstream land uses, to provide a land base sufficient to insure preservation of significant examples of the coastal redwood in accordance with the original intent of Congress, and to establish a more meaningful Redwood National Park for the use and enjoyment of visitors.” [PL 95-250, March 27, 1978]

Three California state parks established in the 1920s—Prairie Creek Redwoods State Park, Del Norte Coast Redwoods State Park, and Jedediah Smith Redwoods—were included within the 1968 congressionally designated national park boundary. Congress expanded the national park in 1978, with most of the lands added in the Redwood Creek basin. Since 1994, the four park units have been managed as Redwood National and State Parks (RNSP) to the greatest extent practicable for better protection of the resources and for the enjoyment and understanding of park visitors. The state parks are administered by the California Department of Parks and Recreation (CDPR, also known as California State Parks [CSP]).

In 1999, the NPS and CDPR completed the joint General Management Plan/General Plan Final Environmental Impact Statement/Plan (GMP/GP FEIS/R) for RNSP. The NPS Record of Decision for the 1999 GMP/FEIS was approved in April 2000. The 1999 GMP/FEIS describes a program for fire management that includes suppression of wildfires, prescribed fire to achieve natural and cultural resource management objectives especially in the Bald Hills area, and management of fuels to reduce fire hazards to natural and cultural resources and human life and safety. This EA is tiered off the GMP/FEIS. Because of the geographic proximity between the three state parks and the national park, the FMP and EA refer to these parks as a single unit to emphasize the shared ecosystems and interrelated biotic communities. However, this EA is consistent with federal regulations and NPS guidelines for implementing the federal National Environmental Policy Act (NEPA) and only applies to federal lands within RNSP.

In 2002, CSP acquired 25,000 acres in the Mill Creek watershed between Del Norte Coast and Jedediah Smith Redwoods State Parks. These lands were added to Del Norte Coast Redwoods State Park in 2004. In 2005, Congress adjusted the Redwood National Park boundary to encompass the newly acquired state park lands. CSP is currently finalizing an amendment (GPA) to the 1999 General Plan to outline management direction for the Mill Creek lands. Because of differences between agency policies, guidelines, and regulations for implementing NEPA and the California Environmental Quality Act (CEQA), CSP will prepare separate environmental documents for fire management actions on state lands within the RNSP boundary in compliance with CEQA.

Fire management activities in the parks include suppression of wildfires, prescribed fire, mechanical fuel reduction, fire ecology research and fire effects monitoring, and fire operations planning. The FMP describes the major proposed actions that would be taken to prepare for wildfires, to reduce the threat of wildfires to park resources, and to prepare for the use of fire to restore ecological conditions and cultural practices that have created the modern landscape of the parks. Despite these goals and any imminent threat to resources from wildfire, protecting human life and safety are the highest priority of all fire management actions. Protecting park resources and park and private property are secondary priorities to protecting human life and safety.

Fire Management Units

A fire management unit (FMU) is any land management area definable by objectives, management constraints, topographic features, access, values to be protected, political boundaries, fuel types, or major fire regime groups, or other consideration that sets it apart from management characteristics of adjacent units. Figures 3.1 and 3.2 in the draft 2010 FMP show the FMUs for the northern and southern parts of RNSP. Each of the six FMUs with the specific fire management projects are also depicted on individual maps (Figures 3.3 through 3.8).

To account for different threats and risks from fire, six fire management units (FMUs) have been established within RNSP based primarily on vegetation types, values to be protected, geography, land ownership and political boundaries, and proximity to urban settings. The three state parks within RNSP are included as a fire management unit because the national park fire management program under the 2005 FMP (no action) included this FMU, because wildfires within any of the four parks have the potential to affect adjacent parklands, and because the California Department of Forestry and

Fire Protection (CAL FIRE) could request assistance from NPS fire resources in the event of a wildfire in a state park adjacent to the national park.

The EA describes the proposed action and alternatives for fire management actions that would occur throughout the park, rather than by individual FMUs. FMUs are outlined here for reference.

Coniferous Forest—67,244 acres. This FMU is subdivided into old growth forests (19,537 ac), second growth forests (46,582 ac), and Sitka spruce forests (1,125 ac). The coniferous forests share fuel types and values to be protected, and have similar fire regimes compared to other vegetation types.

Coastal—6,237 acres in four disjunct areas. This FMU is based primarily on major fire regimes and vegetation related to geographic setting.

Little Bald Hills—1,500 acres as a continuous unit. This FMU is based on vegetation types and major fire regimes.

Bald Hills—5,042 acres more or less contiguous. This FMU is based on vegetation types, values to be protected, and management objectives for cultural resources. The FMU includes all of the Bald Hills Management Zone defined in the 2000 GMP. Prairies and oak woodland vegetation account for about 4,200 acres in this FMU.

Wildland Urban Interface (WUI)—3,490 acres around Orick, Berry Glen, Klamath, Hiouchi, and Douglas Park. This FMU is based on political boundaries and values to be protected. A WUI is defined as a line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The WUI FMU includes all areas within RNSP that border or where a wildfire could affect Communities at Risk as defined by the National Fire Plan and identified in “Urban Wildland Interface Communities Within the Vicinity of Federal Lands That Are at High Risk from Wildfire” (Federal Register, Vol. 66, No. 160, Friday, August 17, 2001, pages 43384-43435).

State Parks—27,100 acres in three state parks within RNSP that were included in this FMU in the 2005 RNSP FMP. 25,000 acres in Mill Creek Watershed were added to Del Norte Coast Redwoods State Park in 2004 but were not covered by the 2005 FMP. This FMU is based on political boundaries and management constraints associated with state law, policies, and regulations. Fire management in the state parks will be conducted under state laws, policies, and regulations. CAL FIRE manages all wildfires on state lands. Fire management operations associated with resource management on state park lands within RNSP are conducted out of the CSP North Coast Redwoods District office in Eureka, California. Although there are no NPS proposals for fire management actions on state park lands within RNSP, NPS fire personnel may be called upon by CAL FIRE to respond to wildfires or may participate in state fire management activities at the request of the state agency.

PURPOSE AND NEED FOR FIRE MANAGEMENT IN REDWOOD NATIONAL PARK

The national and state parks within RNSP include a mosaic of vegetation types that are susceptible to wildfires to varying degrees. The parks are bordered by private property, including both rural and more urbanized residential and commercial properties, and industrial timberlands. Wildfires can endanger human life and can destroy park resources and adjacent private property regardless of where the fire originates.

The purpose of managing fire is to reduce the threat to human life and property both within and outside park boundaries and to park natural and cultural resources from wildfire. Fire itself might be needed as one tool to reduce fuels that have the potential to threaten developments, resources, or public safety. One of the primary purposes of a fire management plan is to develop an overall approach to fire management that focuses on the safety of firefighters and the public. To reduce threats from wildfire to property and resources, hazardous fuel buildups need to be reduced around park buildings, especially historic structures, and in areas where a fire could either enter the parks or move beyond park boundaries; suppression tools such as water sources need to be identified and developed; and tactics need to be planned for safe and efficient actions in case of wildfire.

Another purpose of fire management is to preserve natural and cultural resources that evolved in the presence of fire. Fire is needed as a tool to restore cultural landscapes that were created by intentional ignitions and to restore native plants in grasslands that have been invaded by alien plants. Fires were set by American Indians for a variety of reasons, including increasing acorn production, providing basketry materials, and encouraging new growth of grasses and browse favored by deer and elk. The Euro-Americans who came into the area after 1850 also set fires to create pastures for livestock and to encourage growth of browse for elk. In some areas of the parks, human-caused intentional ignitions have created distinct landscapes called cultural landscapes. Fire has been used as one of the techniques to remove alien plants that compete with native plants as one element of a program to restore native plants.

Fire is a management tool needed to ensure the perpetuation of RNSP ecosystems. A history of fire suppression, along with the development of effective fire suppression techniques, has interrupted the fire regimes that developed in the different RNSP vegetation types and ecosystems for many centuries. A better understanding of these fire regimes is needed to determine the extent to which fire should be restored in RNSP ecosystems and how this would be accomplished.

Laws, Policies, Guidelines, and Plans Relevant to Fire Management

The 2010 FMP is consistent with the following laws, policies, guidelines and plans discussed below. Regulations governing the disposal of wood products generated by fuel reduction projects are also included.

Legislation—Redwood National Park was established by Congress in 1968 “to preserve significant examples of the primeval coastal redwood (*Sequoia sempervirens*) forests and the streams and seashores with which they are associated, for purposes of public inspiration, enjoyment, and scientific study” [Public Law 90-245, Section 3(e)] The park was expanded in 1978 to “protect existing

irreplaceable ... resources from damaging up slope and upstream land uses, to provide a land base sufficient to insure preservation of significant examples of the coastal redwood in accordance with the original intent of Congress, and to establish a more meaningful Redwood National Park for the use and enjoyment of visitors.” [PL 95-250, March 27, 1978]

In 2005, the Department of the Interior published a final rule (48 CFR Parts 1437 and 1452) under the authority found in the NPS Organic Act (16 USC 1) outlining procedures to allow service contractors the option to remove woody biomass by-products generated as a result of Department land management activities whenever ecologically appropriate. Removal of woody by-products by private individuals by permit is allowable under the general regulations for managing the national parks found in 36 CFR 1 et seq. Ecological benefits of removing woody biomass include reduction of the threat of catastrophic wildfire, improved protection of watersheds and wildlife habitat, and improved forest health.

Federal Fire Management Policy—In January 2009, the National Wildfire Coordinating Group Executive Board released memorandum NWCG#001-2009, which revised the 2003 Implementation Guidance to reduce confusion and provide a more flexible approach to wildland fire management that promotes the goal of managing fire to meet safety, protection, and natural resource management goals. The change eliminated the three types of fire in the 2003 guidance and replaced them with two types of fire—planned (prescribed) and unplanned (wildfire). The revision allows fire managers to manage a fire for multiple objectives and increase managers' flexibility to respond to changing incident conditions and firefighting capability while strengthening strategic and tactical decision implementation supporting public safety and resource management objectives.

NPS Management Policies—The NPS will plan for and manage wildland fire in the national park under the authorities of 16 USC 1-4, and as outlined in NPS 2006 Management Policies, Chapter 4.5 (NPS 2006a) and further described in Director’s Order #18: Wildland Fire Management, and its accompanying Reference Manual.

Proposed fire management actions described in the FMP and analyzed in this EA are consistent with management policies that direct the NPS to understand, maintain, restore, and protect the inherent integrity of the natural resources, processes, systems, and values of the parks including

- physical resources such as water, air, and soils
- physical processes such as weather, erosion, and wildland fire
- biological processes such as succession
- ecosystems
- highly values associated characteristics such as scenic views.

Although wildfire is a natural process, it is the policy of the NPS to intervene in natural processes

- in emergencies in which human life and property are at stake
- to restore natural ecosystem functioning that has been disrupted by past or ongoing human activities
- when a park plan has identified the intervention as necessary to protect other park resources, human health and safety, or facilities.

2006 Management Policies identify prescribed burning as an example of active management needed to restore a physical process altered in the past or to maintain the closest approximation of a natural condition when a truly natural system is no longer attainable. NPS policies specify wildland fire as a reason to close areas to visitor use for reasons of public safety.

NPS management policies relating to determination of non-impairment and acceptable impacts are discussed in the Environmental Consequences section of this environmental assessment.

In 2004, the NPS issued a memorandum directing park superintendents to implement the Department's policy to utilize woody biomass by-products from restoration projects wherever ecologically and economically appropriate. The Departmental policy was finalized through the final rule published in the Federal Register [May 20, 2005, Vol. 70, No. 97, pages 29208-29211] which amended 48 CFR Parts 1437 and 1452, described above under applicable legislation.

General Management Plan—The 2000 General Management Plan/General Plan (GMP/GP, USDI and CDPR 2000) summarizes the selected action for fire management analyzed in the 1999 RNSP General Management Plan/General Plan Final Environmental Impact Statement/Report (GMP/GP FEIS/R, USDI and CDPR 1999) and approved through the 2000 Record of Decision (ROD). The GMP/GP focuses on why the parks were established and what resource conditions and visitor experiences should be achieved and retained over time. The GMP/GP provides overall guidance for managing the parks for a period of ten to fifteen years, and constitutes the first phase of tiered planning and decision-making. The plan includes objectives for natural and cultural resource protection, visitor use and enjoyment, and the relationship between the parks and adjacent communities. The GMP/GP also provided more detail on some specific topics including fire and vegetation management.

GMP/GP Natural Resource Management Objectives

- Ensure that all resource management efforts are consistent with and supportive of the perpetuation of the redwood forest ecosystem as the prime resource of the parks.
- Restore and maintain the RNSP ecosystems as they would have evolved without human influences since 1850 and perpetuate ongoing natural processes.
- Cooperate with the timber industry, private landowners, and other government agencies to accomplish long-range resource management planning and reduce threats to the RNSP resources.
- Acquire and analyze baseline inventory data to determine the nature and status of the natural resources under RNSP stewardship.
- Monitor selected resources and environmental factors to detect change and to distinguish natural variation from local and bioregional human-induced resource threats.

The GMP/GP provides more specific direction for achieving the above objectives for two vegetation communities in the parks: second growth forests, and prairies and oak woodlands. Fire management is a separate topic in the GMP/GP. This FMP provides the detail on management actions to achieve GMP/GP objectives.

Second-Growth Forest Management—Second-growth forests may be managed to restore old-growth conditions in the shortest time period possible using a variety of methods and techniques. The NPS approved a plan in 2009 to thin dense second growth forests in about 1,700 acres of the South Fork of Lost Man Creek to reduce the time in which the forests regain characteristics and processes found in mature, naturally occurring forests. Other silvicultural methods such as burning can be considered in second-growth forest management. This FMP does not propose to use prescribed fire as a primary tool to manage second growth or to reduce fuel loading in second growth. Some areas of second growth are a potential fire hazard that would be managed with techniques described in the FMP. Dense stands of second growth are susceptible to fires because of high fuel loading and dense ladder fuels. There are some proposals for mechanical treatments in dense second growth stands to reduce high fuel loads in areas where human safety and property are at risk from wildfires. Woody debris generated by fuel management projects would be removed under permit, consistent with Departmental and NPS regulations and policies described above.

Bald Hills Woodlands and Prairie Restoration—The 1992 Bald Hills Vegetation Management Plan describes management techniques for preserving the prairies (grasslands) that give the Bald Hills their name and the associated oak woodlands. The 2000 GMP/GP identifies the oak woodlands and prairies as having significant natural and cultural values. The native vegetation community is threatened by encroachment of Douglas-fir, which can grow in dense stands that crowd out Oregon white oak, and reduce the extent of grasslands. Alien grasses and other invasive plants reduce native plant diversity. Prescribed fire at certain seasons kills alien grasses and encourages growth of native grasses. Although prescribed fire has been used as a tool to kill small Douglas-fir, prescribed fires generally do not burn at temperatures high enough to kill larger Douglas-fir. Larger Douglas-fir must be cut and the trees removed to reduce fuels that would increase fire risk. The current program of conifer removal and prescribed burning emphasizes restoring and preserving prairies and oak woodlands in the Bald Hills. The Bald Hills management program needs to integrate other natural and cultural values into a more ambitious restoration approach that addresses historic natural and cultural processes and practices, and effects on wildlife, cultural landscapes, and traditional American Indian uses in the prairies.

Prairie Management—Although the Bald Hills prairies are the largest grasslands in the parks, there are other naturally occurring prairies and forest openings. These naturally occurring prairies, as well as prairies and oak woodlands maintained by American Indians through burning, would be restored and maintained by reestablishing a historic fire regime. Certain forest openings would be restored and/or maintained where appropriate for the resource values present (e.g., wildlife habitat, cultural landscapes, or aesthetics).

GMP/GP Cultural Resource Management Objectives

Strategies established in the GMP/GP ensure that the NPS fire program meets the requirements of applicable Federal law, primarily the National Historical Preservation Act of 1966, as amended, and implementing regulations (36 CFR Part 800).

- Recognize the past and present existence of peoples in the region and the traces of their use as an important part of the environment to be preserved and interpreted.

- Expand the cultural resource program from one that is project and compliance based to one that includes comprehensive study.
- Provide for more active integration of the cultural resources and interpretation functions. For example, explain the interplay through time between human activity and the environment and the effects of changes in technology on this interplay.
- Emphasize the development of publications for visitors that present the results of cultural resource studies.
- Ensure the participation of American Indian tribes and groups in managing the parks' natural and cultural resources of interest and concern to them.
- Support the continuation of traditional American Indian activities on RNSP and aboriginal lands, to the extent allowed by applicable laws and regulations.

Cultural Landscape Management—A cultural landscape is a geographic area whose elements and appearance have developed as a result of human-caused actions or intervention. Several cultural landscapes within the parks are closely tied to fire management. The Bald Hills, which include the Lyons' Ranches Historic District and the Bald Hills Archeological District, is a complex landscape influenced by the interrelationship between landform restoration, vegetation management programs, and the concerns of American Indians.

In addition, the Bald Hills is also an ethnographic landscape (Gates et al, 2000, 2002) reflecting the direct result of past American Indian land uses and traditional land management practices. For example, there are patches of camas and hazel in the Williams Ridge area of the Bald Hills that may exist only because the plants were introduced, tended and harvested under an Indian land management regime over millennia.

Although the primary guidance for this area is the 1992 Bald Hills Vegetation Management Plan, a cultural landscape management plan will be prepared to outline areas of cultural significance to American Indian tribes where fire was used traditionally to manage vegetation resources for food, basket materials, and other culturally significant products.

Fire in Relation to General Management Plan/General Plan Objectives

The fire management program will be planned and implemented in support of the resource management strategies outlined above. The program is based on sound risk management, economic feasibility, the best available science, cooperation with other agencies and local tribes, and consideration for public health and environmental quality. The program will allow for wildfire suppression and prescribed fire.

Techniques other than fire will also be used to reduce fuel hazards in second-growth forests and around developments and structures to reduce the risks of damage from wildland fires. Fuel reduction actions involve mechanical removal of fuels with tools such as chainsaws, mowers, or weed whackers. After fuels are cut, the cut pieces are piled and burned (pile burning). The NPS will use available authorities to dispose of woody debris, including selling logs generated by second growth and fuel management projects to offset NPS costs to administer the project and permitting the disposal of woody debris as firewood to reduce fuel build-up.

Restoration of fire as a natural process in old-growth forests, prairies, oak woodlands, and coastal shrub communities will be considered in relation to management objectives for protecting human safety and personal property as well as for perpetuation of the redwood forest and other park ecosystems.

Forest Plant Pathogens

Two closely-related non-native fungi threaten native plant species and communities within the park.

Port-Orford-cedar Root Disease Management—Port-Orford-cedar (POC) is an economically and ecologically valuable species in the Pacific Northwest that is currently threatened by an introduced pathogen (*Phytophthora lateralis*) that causes Port-Orford-cedar root disease. Some individuals and small stands of POC in the northern part of the parks are infected with root disease and have been killed or are dying. The naturally occurring POC in the parks are concentrated in the Little Bald Hills area. The soils and plant communities in the Little Bald Hills are unique in the parks.

While the majority of POC occur outside the parks, the NPS is cooperating with the USFS to manage the park stands to reduce the chances of spreading root disease beyond currently infested area. The 2004 Port-Orford-cedar Management Plan describes management actions to reduce the spread of POC root disease and ensure continued survival of POC in RNSP.

There are no proposals to use fire as a tool for managing POC to control root disease. However, the root disease can be carried into uninfected areas through movements of humans and vehicles. Fire management activities including prescribed fire and wildfire suppression will be conducted using techniques known to reduce the chance of transporting the disease to uninfected areas.

Sudden Oak Death Management—Sudden Oak Death (SOD) is caused by a pathogen closely related to the POC root disease pathogen. SOD is known from areas about 30 miles both north and south of RNSP but has not yet been detected in the parks. Like POC root disease, the SOD pathogen arrived from plant products imported from Asia. SOD infects California bay laurels, Pacific rhododendron, and most importantly, tan oak, a major component of park forests. SOD causes almost 100% mortality of tan oaks in California. Besides its importance in forest ecosystems along the California Coast Range, tan oak has played a critical role for California Indians as a source of acorns for food and basketry materials. In Monterey, Marin, and other counties in central and northern California, standing tan oak killed by SOD have increased hazardous fuel levels. Prescribed fire has been shown to be effective as a tool for controlling the spread of SOD. The NPS is developing a strategy for managing SOD in national parks in northern California, including Redwood National Park; the strategy will consider the use of fire.

Consultation with Other Agencies

Endangered Species Consultations—Section 7(a) 1 of the Endangered Species Act (ESA) of 1973, as amended, requires that Federal agencies utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Section 7(a) 2 of the ESA requires that a Federal agency, in consultation with and with the assistance of the Secretary of the Interior, ensures that any action it authorizes, funds, or carries out is not likely

to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of critical habitat.

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996, (P.L. 104-276; (16 U.S.C. 1801 et. seq.)), requires Federal agencies to consult with the National Marine Fisheries Service (NMFS) regarding any action or proposed action that may adversely affect essential fishery habitat (EFH) for Federally-managed fish species under consultation requirements (sec. 305 (b) (2) and 305 (b) (4) (B)) and ESA/EFH parallel consultation guidelines established by U.S. Department of Commerce NOAA Fisheries.

Specific management direction for each of the listed threatened, endangered, or candidate species that might be affected by fire management activities in the 2010 FMP are reviewed in NPS biological assessments submitted to the US Fish and Wildlife Service (USFWS) or NMFS as well as Sakai (2003) and the subsequent addenda.

Consultation for the 2010 FMP was initiated at the quarterly RNSP interagency consultation team meeting on February 10, 2009. National and state park resource management and fire personnel met with representatives of USFWS, NMFS, and state fish and wildlife regulatory agencies to review the proposed action and outline preliminary determinations. The NPS submitted a draft biological assessment to the USFWS on June 8, 2009 and received comments on June 23, 2009.

Consultations with NMFS for Effects on Fish from Fire Management Actions—Previous consultations for effects on fish from fire management actions similar to those in the 2010 FMP were conducted in 2002 and 2005. The NPS received letters of concurrence from NMFS dated June 10, 2002 (NOAA Fisheries Administrative File # 51422SWR02AR6328) and January 21, 2005 (NOAA Fisheries Administrative File # 151422SWR04AR9140:BW). There were no impacts to listed fish or their habitat from past fire management activities.

On September 4, 2009, the NPS sent a letter to NMFS requesting formal consultation for effects on fish from proposed fire management actions. NMFS has indicated that they will concur with the NPS finding that prescribed burning in two prescribed fire units in tributaries of Redwood Creek may affect and is likely to adversely affect an unknown and unquantifiable but presumably small number of California coastal Chinook salmon, northern California steelhead trout or southern Oregon/northern California coastal coho salmon and their critical habitat due to minor amounts of short term ash sedimentation.

Consultations with the USFWS for Effects on Terrestrial Species from Fire Management Actions—The potential effects on terrestrial species of many of the proposed actions in the 2010 FMP have been assessed in consultations for other activities.

Four consultations were specifically related to fire management. Two consultations were not completed due to complexity and changes in management direction (2000 Draft Biological Assessment of the Impacts to Threatened and Endangered Species From Oak Woodland Restoration and Prescribed Fire in Prairies, Woodlands and Old Growth Forest in Redwood National and State

Parks, and 1999 Draft Biological Assessment of the Impacts to Threatened and Endangered Species From Vegetation Management Program Activities in Redwood National and State Parks.) The NPS received a letter of concurrence (reference number 1-14-2002-1221) from the USFWS dated June 10, 2002 for prescribed burns conducted between 2002 and 2004. A subsequent USFWS letter of concurrence dated October 25, 2004 (reference number 1-14-2005-2389) for the consultation on the 2005 FMP will expire on December 31, 2009.

Helicopters may be used for igniting prescribed fires or emergency wildfire suppression. Helicopter use for ignition is covered under a specific consultation for which USFWS issued a letter of concurrence and a biological opinion on March 29, 2001 (reference number 1-14-01-934) and June 27, 2001 (reference number 1-14-01-888), respectively. That consultation is valid through June 2011. Helicopter use for a wildfire emergency will be addressed in an individual consultation after the emergency.

Portions of the proposed action involving maintenance activities near historic structures and the periodic maintenance of existing roads were analyzed in separate consultations in 1998 that have since been renewed under a new consultation entitled “A Biological Assessment of the Impacts to Terrestrial and Non Anadromous Federal and State Threatened, Endangered and Candidate Species from Maintenance Programs At Redwood National and State Parks.” (USFWS reference number 8-14-1998-24).

On August 12, 2009, the NPS sent a biological assessment dated August 4, 2009 to the USFWS Arcata Fish and Wildlife Office requesting concurrence with the NPS determination of effects on terrestrial species from proposed fire management actions. The NPS received a letter of concurrence from the USFWS on September 15, 2009 (USFWS file no. 8-14-2008-3562 81331-2009-I-0070). The USFWS concurrence is valid through December 2015.

Cultural Resource Consultations—Federal land managing agencies are required to consider the effects of their proposed actions on properties listed in, or eligible for inclusion in, the National Register of Historic Places [NHPA] (i.e., Historic Properties), and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment as per the National Historic Preservation Act, as amended and its implementing regulations 36 CFR Part 800. Agencies are required to consult with Federal, state, local, and tribal governments/organizations, identify historic properties, assess adverse effects to historic properties, and negate, minimize, or mitigate adverse effects to historic properties while engaged in any federal or federally assisted undertaking (36 CFR Part 800). Requirements for proper management of museum objects are defined in 36 CFR Part 79.

On August 19, 2009, the NPS initiated consultation on the fire management plan with the California State Historic Preservation Officer (SHPO) and with the Elk Valley Rancheria Tribal Historic Preservation Officer (THPO), the Smith River Rancheria THPO, and the Yurok THPO on October 8, 2010 under Section 106 of the National Historic Preservation Act (35 CFR 800) for the 2010 Amendment to the 2004 Redwood National and State Parks Fire Management Plan and Environmental Assessment and as required under the 2008 Programmatic Agreement Among the

National Park Service (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers.

On October 13, 2009, the NPS initiated government-to-government consultation on the fire management plan with the Big Lagoon Rancheria, Elk Valley Rancheria, Hoopa Valley Tribe, Resighini Rancheria, Smith River Rancheria, Tolowa Nation, Trinidad Rancheria, and the Yurok Tribe.

Public Involvement

In September 2009, the two local newspapers of record, the Eureka Times-Standard (Humboldt County) and the Del Norte Daily Triplicate (Crescent City, Del Norte County) published front-page articles on the prescribed burns conducted in the park under the 2005 FMP. A scoping letter announcing that a plan was being prepared was sent on October 9, 2009 to 109 recipients including elected officials, individuals, organization, and agencies, and eight local tribes and tribal representatives. The NPS received two requests for clarification of the timeline for the plan and one additional request for a copy of the plan.

This EA or an announcement that the EA was available at park offices and on the park web site on the internet (parkplanning.nps.gov) was sent to agencies, tribes, and organizations listed in the Coordination and Consultation section at the end of this EA, and to interested and affected individuals.

ALTERNATIVES

Alternatives for Fire Management in Redwood National Park

This section describes alternatives for managing fire on federal lands within RNSP from 2010 through 2015. Fire management activities will differ depending on the resources and values of a particular area of the park, the risk of fire in that area, and the threat that fire poses in that area.

Some fire management actions related to protection of significant resources and life, health, and safety are required by federal law and regulations and are not subject to NEPA analysis. No alternatives have been developed for these actions.

Fire management actions that will occur throughout the parks include suppression of all wildfires, especially those that threaten historic structures, residences, and other occupied structures; and safety precautions for personnel involved in fire management.

Safety of firefighters and protection of human life are the paramount concerns of fire management. While there are alternatives for the level of planned fire protection for structures and areas where human health, life, and safety would be affected, there are no alternatives for protection of human health, life and safety when threatened directly by wildfire.

Three alternatives for fire management on federal lands within RNSP are analyzed in this environmental assessment:

- Alternative 1: 2010 Fire Management Plan actions (the proposed action)
- Alternative 2: No Action (2005 Fire Management Plan actions)
- Alternative 3: Full Suppression Only

A no action alternative is required under NPS guidelines for compliance with the National Environmental Policy Act (NEPA) and is used to compare existing conditions with the proposed action. No action means either a continuation of existing management practices or “no project.” In the 2005 Fire Management Plan (FMP), the no action alternative was a “no fire management” alternative that included only suppression of wildfires but no active fire management projects such as prescribed fires, preparation for suppression such as installation of water tanks, and no fuel management such as shaded fuel breaks. In this 2010 FMP, the no action alternative is the current management action, which includes management of fire and fuels under the approved 2005 FMP (Alternative 2). Alternative 3 (suppression only) in this 2010 FMP is a “reaction only” alternative. This alternative is used to compare the effects of the proposed fire management actions with what would occur without active management to reduce excess fuels or prepare for wildfire suppression.

ACTIONS COMMON TO ALL FIRE MANAGEMENT ALTERNATIVES

Certain actions would be used to manage fire throughout RNSP under the proposed action (Alternative 1, 2010 FMP). These are also part of the current fire management program (the no action alternative, Alternative 2, 2005 FMP actions).

1. safety for fire fighters, park visitors, adjacent communities, and the general public
2. communication, information, and public education
3. preparation for suppression of wildfires and for implementing prescribed fires
4. use of minimum impact suppression tactics (MIST)
5. post-fire restoration or rehabilitation, including burned area emergency rehabilitation (BAER) and burned area rehabilitation (BAR)
6. water quality and soil protection
7. protection of sensitive plants and animals
8. protection of cultural resources
9. monitoring

Wildfire Suppression

Suppression of wildfires would occur throughout the park under all alternatives, consistent with federal and NPS fire management policies for managing planned (prescribed) fires and unplanned wildfires. The objectives for managing wildfire are to suppress wildfires using minimum impact suppression tactics (MIST) to minimize resource loss and suppression impacts to resources and values.

Under Alternative 3 (suppression only), fire management on federal lands within RNSP would be limited to full suppression of all wildfires without any preparation for suppression actions or active management of fuels. Alternative 3 (suppression only) does not include preparation for suppression actions that are included in the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) such as installation of water tanks, maintenance of ponds, construction of shaded fuel breaks, fuel reduction around historic structures, or maintenance of roads that would be used primarily for access for fire equipment and personnel.

There are guidelines to protect significant resources that might be affected by suppression actions in areas where there would be no other active fire management such as prescribed fire. There are differences among the FMUs for how aggressively the suppression is applied. For example, aggressive suppression in a second growth forest might involve cutting trees to reduce fuels and to construct a more effective fire line. In old growth forests on federal lands, cutting old growth trees would be avoided to the greatest extent practicable, and suppression actions would involve bucket drops on individual trees before a decision is made to cut the tree. In areas where there are soils that erode easily, fire lines might be located so that erodible soils are avoided, even though the fire might burn a larger area. Streams available for water drafting have been identified as part of preparation for suppression. Any drafting from anadromous fish bearing streams including Redwood Creek, the Klamath River, or the Smith River requires a fish screen on the drafting hose to protect sensitive fish species.

Guidelines were developed to reduce or eliminate potential impacts to threatened, endangered, and candidate species from wildfire suppression activities as part of the Fire Management Plan (NPS 2009 b, c). These wildfire suppression guidelines are not proposed actions because the unpredictability of wildfires and the subsequent potential threats to human safety and significant resources could require accepted suppression tactics that would possibly overrule some or all of the recommendations in the guidelines. Any wildfire suppression tactics and activities that affected animals listed or proposed for listing as threatened or endangered species will be analyzed after the wildfire emergency has passed under emergency procedures for endangered species consultations.

Minimum Impact Suppression Tactics

Minimum impact suppression tactics (MIST) would be employed during suppression actions in the most sensitive resource areas to reduce adverse effects on resources that result from the suppression actions rather than from the fire itself. MIST are part of the proposed action (Alternative 1, 2010 FMP), no action (Alternative 2, 2005 FMP), and Alternative 3 (suppression only).

MIST can be used for prescribed fires more easily because the location of fire lines, access, and staging areas are known in advance. In addition, the fuel types and general fire behavior in a specific fuel type are known and fuels can be managed in advance to reduce the intensity of a fire. Sensitive resources have been identified and mapped throughout the park as part of preparation for wildfire suppression and prescribed fires. The range of suppression actions can be predicted with reasonable certainty for a given fire intensity in a given vegetation type. Based on these predictions in combination with knowledge of specific resources, suppression techniques can be prescribed to minimize both short and long-term effects on sensitive resources, as well as to minimize costs associated with fire suppression.

MIST include but are not limited to minimizing the size of fire lines, placing the fire lines in the areas with the least sensitive soils or vegetation, restricting flight paths over suitable habitat areas during sensitive species breeding seasons, avoiding placing fire retardant in streams, using fish exclusion screens when drafting water from streams, locating fire camps and heliports in the least sensitive areas such as previously disturbed areas or existing campsites, avoiding riparian zones and streams, minimizing cutting of large or live trees, minimizing cutting large snags and logs, cutting trees flush to the ground rather than leaving large stumps, packing out garbage, and removing signs of human activity.

Post-fire Rehabilitation and Restoration

Post-fire rehabilitation and restoration activities are part of the proposed action (Alternative 1, 2010 FMP), no action (Alternative 2, 2005 FMP), and Alternative 3 (suppression only). There are two types of rehabilitation or restoration of burned lands following a fire depending on whether the fire was prescribed or a wildfire. Rehabilitation after prescribed fires is planned as part of preparation for prescribed fire. Burned area emergency rehabilitation, also called burned area emergency restoration (BAER), is done after a wildfire where the exact location, extent and severity of the fire cannot be planned and where an emergency situation exists that continues beyond the actual fire emergency.

Preparation for Suppression and Prescribed Fires

Preparations for suppression and prescribed fires are part of the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP). Under Alternative 3 (suppression only), there would be no on-the-ground preparations for suppression of wildfires other than identifying access, terrain, and water sources, and establishing the most cost-effective fire organization.

Under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP), preparations for fire management actions focus on establishing safe and effective suppression actions with minimal adverse effects on sensitive resources from both wildfire and suppression. These actions include identifying access roads and water sources, preparing roads for access by equipment, installing water tanks, and clearing vegetation from around ponds to provide safe access by helicopters, fire engines, and water tenders. Preparation for prescribed fire include preparing the burn units by reducing excess fuels and constructing fire lines, establishing a monitoring program, monitoring pre-burn conditions, and ensuring that adequate fire personnel are available and trained to conduct prescribed burns.

Prescribed Fire

Prescribed fires are fires ignited by park managers to achieve resource management and fuel treatment objectives. Prescribed fire activities include monitoring programs that record fire behavior, smoke behavior, fire decisions, and fire effects to provide information on whether specific objectives are met.

Two types of prescribed fires are proposed, pile burning and broadcast burning. Pile burning involves cutting, piling, and burning excess fuel. Broadcast burning involves burning blocks of fuels within an area contained by a fire line. In this plan, prescribed fire generally refers to broadcast burning if pile burning is not specified.

All prescribed fires require preparation that includes fuel management. Preparation methods include cutting grass with line trimmers and mowers along fire lines; constructing fire line with chainsaws and hand tools; installing fire hoses; and setting up and filling portable water tanks.

Broadcast burns require fire line construction. Two types of fire lines would be used, constructed lines and wet lines. Fire lines vary according to fuel type and time of year burning would be conducted. Wet lines would be used for burns scheduled for late in the season that rely on precipitation to reduce the potential for unplanned spread. Wet lines are either naturally occurring changes in fuel moisture on forest-grassland edges or created by the direct application of water to vegetation prior to ignition. Constructed fire lines have vegetation scraped off and are then dug to mineral soil to a width of no more than four feet. Constructed lines would be rehabilitated after a prescribed burn by replacing the topsoil. Fire lines in grasslands may also have fuels mowed adjacent to the fire line. In oak woodlands or areas bordered by dense small conifers, ladder fuels adjacent to the line would be cleared by cutting back brush, removing lower limbs of trees, and cutting trees less than 18 inches diameter at breast height (dbh).

Pile burning is used to reduce excess fuels generated from creating a shaded fuel break, from around historic structures, or to reduce high volumes of fuels within a burn unit where broadcast burns are planned. Some fire prescriptions require pile burning before broadcast burning to enable fire crews to contain a broadcast burn within the burn unit boundaries and to ensure safety of fire personnel by reducing very high fuel levels.

Broadcast burns would be ignited with diesel drip torches and fusees [similar to emergency road flares]. Aerial ignition from helicopters may be used in some units, particularly in the Wildcat unit in the Bald Hills. Personnel committed to each prescribed burn may include up to 15 to 20 overhead positions, two hand crews, four engines, one helicopter, one water tender, portable tanks and pumps, hoses, and related equipment.

Resource Protection and Mitigation Measures for Action Alternatives

Air Quality

A Smoke Management Plan would be filed with the North Coast Unified Air Quality Management District (NCUAQMD) as part of the Prescribed Fire Plan for each unit. Units would be burned only on “burn days” as declared by the air quality district, unless a variance is obtained. The district considers wind speed and direction, atmospheric stability, fuel type and amount, ignition pattern, and proposed number of acres to be burned when granting a burn clearance. The ignition technique and number of acres to be burned would be modified as needed to obtain a burn clearance from the air quality management district. The NCUAQMD grants variances only on a limited basis.

Endangered Species Protection Measures

To protect endangered species, the NPS, USFWS and NMFS have agreed on mitigation measures to reduce adverse impacts from actions that have the potential to adversely affect listed species (NPS 2009 b, c).

The most common mitigation measures include surveys to determine the presence or absence of a species, restrictions on when certain actions can occur, the distance between an action and suitable habitat, and how an action is undertaken. Surveys are done for terrestrial plants and wildlife. Restriction periods are established for wildlife and fish.

Surveys—Surveys are done in some areas where an action is proposed. Some surveys are done specifically to determine presence or absence of a species; these surveys tend to require more time and personnel and cover small areas. Other surveys are done to determine if there is suitable habitat; these surveys cover more area but do not provide information on the actual presence or absence of a species.

Restriction Periods—Birds and mammals are susceptible to disturbance during breeding seasons. Breeding seasons are considered to include times during which mating, nesting, and raising young occur. Disturbance includes noise that can scare wildlife and effects on habitat such as falling nest trees, cutting brush, and creating dense smoke in an area.

Equipment, techniques, or activities that generate above ambient noise levels are restricted to certain seasons to protect wildlife during their breeding seasons. This generally means no use of mechanized equipment such as chainsaws except immediately next to a high-use road or high-use visitor facility that regularly generates noise greater than background (ambient) noise. Pile and broadcast burning are restricted because smoke adversely affects wildlife during the breeding seasons.

Restrictions on when an activity can occur vary for each species depending on a combination of the distance between the activity and suitable habitat, the type of action, whether surveys have been done, and the stage in the breeding cycle. Different restrictions apply to northern spotted owls, marbled murrelets, and Pacific fishers for disturbance from noises that are louder than ambient noise, from removal of habitat, from drifting smoke, and whether surveys have been done. Noise restrictions apply to actions within suitable habitat or within a certain distance of suitable habitat depending on the noise level. The term “restriction period”, e.g. “owl restrictions”, “murrelet restrictions”, or “fisher restrictions” is used to refer to the time of year during which no louder-than-ambient noise, smoke from prescribed fires, or vegetation removal is permitted in a given area where certain species might be adversely affected by noise and disturbance, smoke, or habitat destruction. The spotted owl restriction period runs from February 1 through July 31. If surveys indicate that spotted owls are raising young, the restriction period extends to September 15. For marbled murrelets, the noise restriction period is March 24 through September 15. For Pacific fishers, the restriction period is March 1 through June 15. If surveys indicate that a female fisher is raising young in an area (maternal denning), the restriction period extends to July 31. Since habitat suitable for one species is often suitable for a different species, but surveys have only been done for one species but not another, restriction periods may be combined. Suitable murrelet habitat is also suitable for northern spotted owls. Suitable fisher habitat is essentially the same as suitable spotted owl habitat. All habitat suitable for either murrelets or fishers is assumed to be occupied because it is not cost-effective to conduct surveys that confirm presence or absence of these species. Thus, the longest restriction period in habitat suitable for murrelets, owls, and fishers will be February 1 through September 15. Activities that have the potential to adversely affect murrelets, owls, and fishers in suitable habitat or where these species are assumed or known to be present are permitted from September 16 through January 31. Shorter restriction periods are possible depending on the species, the habitat, and the activity.

Anadromous Fish-Bearing Stream Protection Measures—All streams throughout RNSP occupied by listed anadromous fish or suitable for occupation by any life stage are designated as critical habitat for one or more listed anadromous species. Best management practices would be used to avoid sediment delivery into such streams. These practices include use of silt screens, work only during dry periods or when the soils are not saturated, no refueling of equipment within 150 feet of a stream, a fuel spill prevention plan for fueling and for on-site equipment, use of weed-free straw on exposed soils until revegetation is complete, and stabilization of any structures within the inner gorge of streams to prevent bank erosion. Work occurring near anadromous fish-bearing streams during the breeding season will have visual disturbance restrictions in place to prevent the disturbance of spawning salmon and trout. No piles would be burned within 300 feet of any intermittent or perennial stream.

Cultural Resource Protection Measures

Cultural resources in RNSP consist of archeological sites and features, historic structures and features, cultural landscapes, and resources of ethnographic significance. The National Historic Preservation Act, as amended (16 U.S.C. 470f), requires that federal agencies take into consideration the affects of their undertakings on cultural resources, also called “historic properties,” that are eligible for or are listed on the National Register of Historic Places. Since fire and suppression activities may have an effect on cultural resources, the following protection measures will be employed.

Cultural resources will be protected from fire using two different sets of actions, depending on whether the timing and location of the fire can be predicted.

For prescribed burns and mechanical fuel reduction projects, cultural resource protection measures are incorporated into project planning. These measures include but are not limited to the following.

- Consult with the affiliated Tribes, cultural resource advisors at the NPS Pacific West Regional Office, and the SHPO/THPO.
- Identify historic properties within the area of potential impact for the undertaking.
- Assess potential for adverse effects to historic properties.
 - Complete hazardous fuel assessments when historic properties are present.
- Develop appropriate management recommendations to mitigate adverse effects to historic properties in consultation with affiliated Tribes, cultural resource advisors at the NPS Regional Office, and the SHPO/THPO. General strategies currently employed for historic property protection include:
 - Planning and implementing prescribed burns to take advantage of environmental conditions that minimize impacts to cultural resources.
 - Avoiding historic properties during fire program operational activities.
 - Excluding fire from historic properties
 - Minimizing the impact of fire through fuel load reduction around historic properties.
 - Conducting preventative maintenance consisting of hazard fuel reduction at or around historic properties.
 - Employing environmentally friendly MIST in the vicinity of historic properties.
- Monitoring archeological sites as defined in the cultural resources fire monitoring section of the Cultural Resources Appendix of the Fire Management Plan.
- Develop appropriate management recommendations based on general strategies to mitigate adverse effects to historic properties (see Table 1 for general strategies)

Table 1—General Strategies to Mitigate Fire Program Impacts to Cultural Resources

Direct Fire Impacts	Operational Impacts	Indirect Impacts
Archeological Resources		
Fuel load reduction on/or near resources Exclude fire from the resource Consult with archeologist regarding ignition methods Fire effects research	Avoid resource with operational activities, and/or use MIST strategies Fire-fighter resource awareness training	Post-burn monitoring and assessment Hazard fuel removal Document or collect exposed artifacts Erosion controls where appropriate Increased law enforcement patrol

		where appropriate
Historical Structures		
Consult with historic architect Conduct scheduled preventative maintenance where appropriate Fuel load reduction or exclude fire from the resource Apply fire shielding/foam in the event of fire	Consult with historic architect Avoid resource with operational activities, and/or use MIST strategies Fire-fighter resource awareness training	Consult with historic architect Post-burn monitoring and assessment Erosion controls where appropriate Hazard fuel removal
Ethnographic Resources		
American Indian consultation American Indian fire use research Fuel load reduction or exclude fire from the resource Consult with archeologist regarding ignition methods	American Indian consultation Avoid resource with operational activities, and/or use MIST strategies	American Indian consultation Post-burn monitoring and assessment Erosion controls where appropriate Hazard fuel removal
Cultural Landscapes		
Consult with landscape architect Fuel load reduction or exclude fire from the resource Consult with archeologist regarding ignition methods	Consult with landscape architect Avoid resource with operational activities, and/or use MIST strategies	Consult with landscape architect Post-burn monitoring and assessment Erosion controls where appropriate Hazard fuel removal

In the case of wildland fire, suppression activities in the vicinity of cultural resources would be conducted to minimize adverse effects from suppression itself as well as from the wildfire. As part of the planning for suppression and suppression activities, the NPS will

- Maintain and make available cultural resource digital databases and GIS layers on CDs or other portable digital format during fire season to expedite the management decision making process.
- Notify immediately the park cultural resources program manager and/or Northern California Sub-cluster fire archeologist in the event of wildfire that requires extended attack.
- Require consultation with an archeologist and/or other cultural resource specialist and notify SHPO/THPO if extended attack is needed and the wildfire is in an archeologically or culturally sensitive area.
- Consult with affiliated tribes when resources of ethnographic significance are threatened by fire or fire suppression activities.
- Ensure that historic structures, cultural landscapes, archeological sites, and resources of ethnographic significance that are determined eligible or listed on the NRHP are prioritized in resource protection planning.
- Consult with the SHPO/THPO, affiliated American Indians and stakeholder, and cultural resource advisors at the NPS Regional Office in the planning and execution of rehabilitation efforts following wildfires.
- Employ environmentally friendly, minimum impact rehabilitation/suppression techniques (MIST) in the vicinity of cultural resources.
- Conduct post-burn inventories and cultural resource condition assessments.

ALTERNATIVE 1: 2010 FIRE MANAGEMENT ACTIONS (THE PROPOSED ACTION)

The proposed action includes fuel management; historic structure protection; preparation for suppression; and prescribed fire. These actions would occur throughout the national park.

Fuel Management

Fuel management would reduce threats from wildfire to property and resources by reducing hazardous fuel buildups around park buildings or facilities and in areas where a fire could either enter the park or move beyond park boundaries. Proposed fuel management projects include shaded fuel breaks and firewood disposal.

Five shaded fuel breaks would be created or maintained over the life of the 2010 Fire Management Plan to provide more secure and defensible park boundaries, defensible spaces around park developments, and escape routes from facilities and areas frequented by park staff and visitors in the event of a wildfire. Shaded fuel breaks also provide a safe place from which fire crews can operate. Shaded fuel breaks are 100-foot-wide strips along either side of roads or around building complexes where fuels that could allow a fire to move from the ground up into the forest canopy (ladder fuels) have been removed or reduced. Breaks are created by cutting live trees less than 12 inches dbh, brush, and lower limbs of trees. Existing canopy cover would be maintained above 60% for wildlife habitat and esthetic values. All attempts would be made to leave all trees less than 12 inches dbh if they have broken or deformed tops; these trees may develop into future nest or roost trees for spotted owls. Cut trees and limbs would be piled away from live trees, logs more than 36 inches diameter on the wide end and longer than 10 feet, and snags larger than 24 inches dbh within the units or on the roads. Cut material would either be pile-burned during the wet season or chipped with a mechanical chipper, outside of the endangered species restrictions periods.

Fuel breaks totaling 468 acres would be located

- along Holter Ridge Road (aka Lost Man Creek Trail)/B Line Road from the Bald Hills Road north to US Highway 101 (368 acres);
- along the Bald Hills Road from the Holter Ridge Road junction to Elk Camp Prairie (75 acres);
- the Wolf Creek Outdoor School Access Road and housing complex/fire cache (15 acres);
- around the Hiouchi park housing and fire cache complex (15 acres); and
- around the Howland Hills Outdoor School access road and complex (25 acres).

Portions of the Holter Ridge Road/B Line Road fuel break are either entirely within, immediately adjacent to, or within 0.25 mile of suitable habitat for marbled murrelets, northern spotted owls, or Pacific fishers. Spotted owl surveys have been completed for the Holter Ridge Road portion but not the B Line Road portion of the Holter Ridge/B Line Road fuel break. No work would occur along the B Line Road portion from February 1–September 15 in those sections within 0.25 mile of suitable marbled murrelet and/or unsurveyed spotted owl and fisher habitat. If no owls are found during continued surveys of the Holter Ridge portion, then noise restrictions would apply from March 24–September 15 within 0.25 mile of suitable marbled murrelet habitat or from March 1–June 15 within 0.25 mile of suitable fisher habitat. If spotted owls are found and have produced fledglings, work restrictions would apply through September 15 within the core area of the spotted owl nest site.

No noise restrictions would apply to the Bald Hills Road shaded fuel break because Bald Hills Road is a high-use public road with a very high ambient noise level. Commercial logging trucks routinely use engine compression (“jake” brakes) along the entire length of the Bald Hills Road shaded fuel break project area.

The Wolf Creek housing/fire cache complex is within 0.25 mile of suitable marbled murrelet, spotted owl and fisher habitat but no suitable habitat exists within or adjacent to the unit boundaries. Spotted owl surveys have been initiated for the housing and fire cache complex. If spotted owls are found to be nesting, work within the nesting core area would be restricted to September 16–January 31. If no owls are found, then noise restrictions would be required from March 24–September 15 only in those sections within 0.25 mile of suitable marbled murrelet habitat, and areas within 0.25 mile of habitat suitable for fishers only would have a March 1–June 15 noise restriction period.

Hiouchi park housing and fire cache are not in or within 0.25 mile of any suitable listed species habitat. No noise restrictions apply.

The Howland Hill Outdoor School complex and access road are in suitable spotted owl/fisher habitat. No restrictions apply to most of the project area. Since surveys of the outdoor school complex and access road indicate that the area is currently occupied by barred owls, no spotted owl restrictions apply. Work on the far western portion of the access road within 0.25 mile of suitable marbled murrelet habitat would be completed between September 16 and March 23, outside of the marbled murrelet noise restriction period.

Firewood Disposal

Preparation for prescribed fires, construction of shaded fuel breaks, and mechanical fuel reduction projects require cutting brush and small trees less than 12 inches dbh. Most of the small trees are Douglas-fir that have encroached into oak woodlands in the Bald Hills. If these materials (slash) are left on the ground, they create an additional fire hazard over several years until they decompose. Some slash would be piled and burned to reduce the fire hazard. Some of the trees are large enough to be suitable for firewood. In locations where there is road access and a suitable staging area, NPS personnel would cut some of the wood generated by fuel reduction projects into firewood lengths and move it to staging areas along existing roads. The NPS would issue free permits to pick up limited quantities of firewood and remove it from the park.

Historic Structure Annual Hazard Fuel Reduction

Overgrown brush and grass would be cleared annually from within 40 feet of seven historic structures in the Bald Hills—Elk Camp Barn, Dolason Barn, Lyons Ranch Barn and Bunkhouse, Dooleyville Line Shack, Long Ridge Sheep Shed, Coyote Creek Barn, and Coyote Creek Cabin—to protect structures from wildfires. There is no suitable habitat for threatened or endangered species that would be affected by these projects; no endangered species restrictions would apply.

Prescribed Fire

Prescribed fire units are areas that can be safely and effectively burned for protection of resources and human health, life, and safety. Most prescribed fire units are in the Bald Hills oak woodlands and grasslands where fire was used by American Indians and early settlers to maintain vegetation for various uses. CSP is proposing to implement prescribed fire in two of the state parks within RNSP (Prairie Creek and Jedediah Smith Redwoods State Parks) and would prepare environmental documents as required under CSP policies and regulations for these projects; these CSP actions and associated impacts are covered under cumulative impacts in the environmental consequences section of this environmental assessment.

Prescribed fire would be used to treat approximately 6,800 acres in 36 burn units of grassland, oak and Jeffrey pine woodlands, coastal grassland and shrubland, and second growth coniferous forest adjacent to grassland or oak woodlands (Table 2).

Areas scheduled for prescribed burns would be prepared to ensure that the fires can be controlled and remain within the burn unit boundaries, and to ensure firefighter safety. Preparation activities include cutting heavy brush and small trees that would not be consumed by fire as desired under certain prescriptions or that would burn hotter than allowed under a prescription, and pile burning the cut material. Broadcast burning involves igniting fires and allowing the fire to spread within the unit up to the boundary outlined by a fireline.

Table 2– Prescribed Burn Units

Burn Unit Name	Total Acres	Vegetation Type	Time of proposed burning	Endangered species restrictions?	Number of intermittent streams w/in 100 feet	Number of perennial streams	
						w/in 150 feet	w/in 300 feet
1) Airstrip, Lower	110	grassland and oak woodland	August 1st to first rains	No (N)	1	0	1
2) Airstrip, Upper	102	grassland and oak woodland	August 1st to first rains	N	0	0	0
3) C-10	339	second growth coniferous forest	September 16th to first rains	Yes (Y)	3	0	0
4) Child’s Hill	561	grassland and oak woodland	August 1st to first rains	Y	3	0	0
5) Copper Creek	148	grassland and oak woodland	August 1st to first rains	N	2	0	0
6) Counts, Upper	118	grassland and oak	August 1st to first	N	1	0	0

Burn Unit Name	Total Acres	Vegetation Type	Time of proposed burning	Endangered species restrictions?	Number of intermittent streams w/in 100 feet	Number of perennial streams	
						w/in 150 feet	w/in 300 feet
		woodland	rains				
7) Counts, Lower	220	grassland and oak woodland	September 16th to first rains	Y	1	0	1
8) Coyote Creek	1,063	grassland and oak woodland	September 16th to first rains	N	5	0	0
9) Davison	10a	grassland	September 16th to first rains	Y	0	0	1
10) DeMartin	5	grassland	September 16th to first rains	N	0	0	0
11) Dolason, Lower	220	grassland and oak woodland	September 16th to first rains	Y	0	0	0
12) Dolason, Upper	94	grassland and oak woodland	September 16th to first rains	Y	0	0	0
13) Dooley-ville	111	grassland and oak woodland	September 16th to first rains	Y	1	0	1
14) Eastside	107	grassland and oak woodland	August 1st to first rains	N	0	0	0
15) Elk Camp, Lower	244	grassland and oak woodland	September 16th to first rains	Y	1	0	0
16) Elk Camp, Upper	37	grassland and oak woodland	August 1st to first rains	Y	0	0	0
17) Enderts	109	coastal grass and scrub	August 1st to first rains	Y	1	0	0
18) Gans, Lower	32	grassland and oak woodland	September 16th to first rains	Y	0	0	0
19) Gans, Upper	17	grassland and oak woodland	September 16th to first rains	Y	0	0	0

Burn Unit Name	Total Acres	Vegetation Type	Time of proposed burning	Endangered species restrictions?	Number of intermittent streams w/in 100 feet	Number of perennial streams	
						w/in 150 feet	w/in 300 feet
20) Holter Ridge Beargrass	5	second growth coniferous forest	September 16th to first rains	Y	0	0	0
21) Lagoon Creek	68	coastal grass and scrub	September 16th to first rains	Y	0	1*	0
22) Little Bald Hills	1,470a	grassland and pine woodland	August 1st to first rains	Y	6	0	0
23) Lyons, Lower	143	grassland and oak woodland	August 1st to first rains	N	2	0	0
24) Lyons, Upper	208	grassland and oak woodland	August 1st to first rains	N	0	0	0
25) Main-stem	166	grassland and oak woodland	August 1st or September 15th to first rains	Y	2	0	1
26) Major Creek	7	coastal grass and scrub	August 1st to first rains	Y	0	1*	1*
27) Maneze	226	grassland and oak woodland	August 1st to first rains	Y	0	0	0
28) Mid Basin	129	grassland and oak woodland	August 1st to first rains	N	3	0	0
29) Pig Pen	69	grassland and oak woodland	September 16th to first rains	Y	0	1	1
30) School House	300	grassland and oak woodland	August 1st to first rains	N	0	0	0
31) South Boundary	86	grassland and oak woodland	September 16th to first rains	Y	1	0	0
32) Tick	34	grassland and oak woodland	September 16th to first rains	Y	0	0	0

Burn Unit Name	Total Acres	Vegetation Type	Time of proposed burning	Endangered species restrictions?	Number of intermittent streams w/in 100 feet	Number of perennial streams	
						w/in 150 feet	w/in 300 feet
33) Upper K&K	40	second growth coniferous forest	September 16th to first rains	Y	0	0	0
34) Wildcat	1,054	second growth coniferous forest	September 16th to first rains	Y	6	1	0
35) Williams Ridge	118	grassland and oak woodland	August 1st to first rains	N	0	0	0
36) Wooden Gate	243	grassland and oak woodland	August 1st to first rains	N	0	0	0

Three units (Major Creek, Lagoon Creek, Enderts) may contain suitable western lily habitat. These units would be surveyed, and if lilies are found, the burn boundaries would be altered to avoid the lilies. Additional information on endangered species restrictions in prescribed burn units are found in the environmental consequences section. Tables 3 and 4 provide the acreage of habitat for listed species affected by prescribed fire and construction of shaded fuel breaks.

Fire management activities in thirteen burn units have no restrictions on timing of activities associated with protection of endangered wildlife species. The other 23 burn units have different restrictions on timing of activities to protect endangered wildlife.

The thirteen burn units located more than 0.25 mile from suitable habitat for endangered wildlife are Airstrip Upper, Airstrip Lower, Copper Creek, Counts Upper, Coyote Creek, DeMartin, Eastside, Lyons Lower, Lyons Upper, Major Creek, Mid Basin, School House, and Williams Ridge. Preparation activities can occur at anytime in these burn units but will generally occur in early summer. Burns will occur after the grass or brush cures, generally mid July, and before the end of the burn season when damp fuels prevent effective ignition.

Five units are entirely within habitat for listed or candidate animal species: Enderts, Little Bald Hills, Holter Ridge Beargrass, Upper K&K, and Wildcat.

Enderts and Little Bald Hills unit are within suitable habitat for Oregon silverspot butterflies and mardon skippers, respectively.

The Little Bald Hills prescribed burn unit would be treated using an adaptive management model to protect the mardon skipper and enhance skipper habitat. Burns would be limited to approximately 50

contiguous acres in a given year. Each 50-acre block within the 1,470 acre burn unit would be burned only once over the five year life of this plan (250 acres total in five years) to provide refuge areas from which mardon skippers can repopulate burned areas (Kerwin 2005). Preparation work would involve felling encroaching conifers up to 12" dbh within grassland areas and piling slash for later burning. No fire lines would be constructed; the wet forest/grassland interface would be used as the burn boundary. All pile burning and broadcast burning within this unit would occur in the fall after first rains after October 1 and before the subsequent rains to minimize adverse effects on mardon skippers that might be present in burn units. Slash from preparation work would be piled on brushy vegetation within the burn unit rather than on fescue grass patches to avoid concentrated heat sources that would destroy grass plants on which butterflies feed and lay eggs. Pre- and post-burn monitoring of skippers and vegetation in and out of the burned blocks would occur every year. If mardon skipper distribution outside of the burn block area falls measurably after burning or if fescue grasses have not regrown one year after burning, then future prescribed burning would cease until biologists and fire management staff reassess the size and arrangement of burn units in cooperation with the USFWS and butterfly experts.

The Enderts burn unit contains suitable habitat for Oregon silverspot butterflies. Although past surveys have never detected silverspots in the park, the burn unit would be surveyed prior to preparation and ignition and the year following the burn. If silverspots are detected prior to the prescribed burn, then the unit would not be burned and park staff would reinitiate consultation with the USFWS.

The Upper K&K, Holter Ridge Beargrass, and Wildcat burn units are within suitable habitat for northern spotted owls and Pacific fishers. Noise-generating preparation activities and burning within these units would take place between September 16 and January 31 to avoid adverse effects on northern spotted owls and Pacific fishers from smoke and noise. If surveys indicate that spotted owls are not present or if a unit is within a "barred owl exclusion zone," the noise restriction period may be shortened to March 1 through June 15 to avoid adverse effects on fishers.

The C-10, Davison, Dolason Lower, Dooleyville, Elk Camp Lower, Gans Lower, Gans Upper, Pig Pen, and Tick burn units are located within 500 feet of, but do not contain, suitable spotted owl, marbled murrelet, or fisher habitat. No burning or preparation activities that generate noise above ambient levels would be allowed in these units between February 1–September 15. The restriction period may be shortened to March 1–September 15 if surveys indicate that spotted owls are not present or if an area is within a "barred owl exclusion zone."

Child's Hill, Dolason Upper, Elk Camp Upper, Maneze, and South Boundary burn units are located within 500 feet of, but do not contain, suitable spotted owl and fisher habitat. All mechanized preparation and burning within these units would occur from August 1–January 31. Unless the work occurs immediately next to a high use road or high use visitor facility, the noise restriction period in these units is February 1–July 31 but may be shortened to March 1–June 15 (fisher only noise restriction period) if surveys determine that spotted owls are not present or if an area is within a "barred owl exclusion zone."

Preparation for Suppression

Two types of actions would be taken to prepare water sources for suppression for wildfire emergencies, maintenance of existing ponds and installation of holding tanks.

Pond Maintenance—Vegetation in and around four ponds built as water sources for livestock or logging operations would be cleared to improve vehicle access and maintain the ponds as water sources for prescribed fires, wildfires, or both. Water would be pumped from the ponds into a pumper truck or fire engine.

The M-Line pond would be used only during wildfire emergencies as a water source for fire engines, water tenders, and helicopters. Any effects to endangered species from use of the pond for emergency wildfire suppression will be analyzed after the emergency. To prepare and maintain the M Line pond for emergency use by water trucks and helicopters, red alder saplings and brush growing along the banks of the pond and a swath of sapling alders and brush approximately 20 feet wide by 150 feet in length from the pond to the nearby Upper B Line Road would be cleared to enable a helicopter carrying a water bucket to safely dip water from the pond and approach and leave the pond without becoming ensnared in the re-growing alders. Preparation and maintenance for use of the M Line pond are subject to spotted owl and fisher restrictions. If spotted owls are present or if no owl surveys are conducted, restrictions would be in effect from February 1–July 9. If no owls are present, fisher noise restrictions would be in effect from March 1–June 15.

The Upper and Lower Elk Camp ponds are within 500 feet of suitable spotted owl and fisher habitat but do not have suitable habitat within the unit boundaries. The small pumps that would be used generate moderate levels of noise; there would be no endangered species restrictions on time of use. Preparation and maintenance for use of the Upper and Lower Elk Camp ponds are subject to spotted owl and fisher noise restrictions. The noise restriction period in these units would be February 1–July 31 but may be shortened to March 1–June 15 (fisher only noise restriction period) if surveys determine that spotted owls are not present. Three-foot-wide paths would be cleared through underbrush and sapling trees to provide access for water suction hoses, portable pumps and associated hoses and operators.

The Coyote pond area has no suitable habitat for endangered species. No restrictions would apply to pulling fallen trees out of the pond.

Holding Tank Placement—Three 2,500-gallon water tanks would be placed on or near roads close to ridge tops to provide water sources for wildland fire suppression. Tanks would be located in the Little Bald Hills along the southeast portion of the Little Bald Hills Trail; at mile 3.5 on Bridge Creek Ridge Road; and on Holter Ridge Road near Bald Hills Road (Holter Ridge south). The tanks would be used both as a water source for fire engines and water tenders for wildfire suppression only. The tanks would be filled with rainwater collected by guzzler-like attachments. Most tanks would be placed on a gravel base on existing flat ground. Some tanks would require the construction of redwood “decks” to create a flat surface for the tank. No vegetation would be removed or altered during holding tank placement. There are no restrictions associated with endangered species protections for tank installation at the Little Bald Hills or Coyote Creek sites. Noise restrictions apply

to tank installation on the Bridge Creek Ridge Road from February 1-September 15 and February 1-July 9 for the Holter Ridge Road site.

Helicopter Use

Timing, elevation and location of helicopter flights in the park are limited by safety requirements and minimization of noise disturbance impacts to threatened and endangered species. Helicopter use will follow general requirements for aircraft and passenger safety outlined by the Department of the Interior Office of Aircraft Services in the Departmental Manual [112 DM 12]. Helicopters en route to and from any burn units that are more than 0.25 mile from suitable habitat for bald eagles, marbled murrelets, spotted owls, and fishers would fly more than 1,000 feet above the forest canopy while over suitable habitat during endangered species noise restriction periods. Helicopters would not be used within 0.5 mile of any known bald eagle nests between January 1–August 31; in suitable spotted owl habitat between February 1–July 31; in marbled murrelet habitat between March 24–September 15; or in fisher habitat between 1 March 1–July 15.

ALTERNATIVE 2: 2005 FIRE MANAGEMENT PROGRAM (NO ACTION)

The fire management program from the 2005 FMP includes the same types of actions as the 2010 FMP proposed action. These actions are suppression of all wildfires; fuel management including shaded fuel breaks and annual fuel reductions around historic structures; preparation for suppression including installation of water tanks and preparation on ponds for access by equipment; and prescribed fire. Many of the actions proposed for the 2010 FMP are continuations of actions initiated under the 2005 FMP or actions that would be repeated, such as prescribed fires that are rotated throughout the units.

2005 Mechanical Fuel Reduction

Mechanical fuel management planned under the 2005 FMP included treatment of Monterey-knobcone pines on the west side of Redwood Creek; three shaded fuel breaks; mechanical fuel reductions in prescribed fire units with structures at risk; and annual fuel treatments around historic structures.

The West Side Pine Removal project on 300 acres of a Monterey-knobcone pine plantation on the west side of Redwood Creek in the Tom McDonald Creek watershed was not undertaken because access roads to the project area were removed under the watershed restoration program. This project is not proposed under the 2010 FMP and would not be included under Alternative 2 (2005 FMP, no action) due to lack of access.

2005 Shaded Fuel Breaks

Approximately 2 miles of the 15 miles of the East Side shaded fuel break planned under the 2005 FMP were completed. The remaining 13 miles and an additional 2 miles are planned under the 2010 FMP proposed action. Under Alternative 2 (2005 FMP, no action), the remaining 13 miles of the East Side Fuel Break would be completed.

Three shaded fuel breaks around the Wolf Creek and Hiouchi fire caches, park housing areas, and border between park land and private residences were established under the 2005 FMP. Maintenance

of these fuel breaks is planned under the 2010 FMP proposed action and would be continued under Alternative 2 (2005 FMP, no action).

2005 Fuel Reduction for Prescribed Fire Units

Four mechanical fuel reduction projects in the vicinity of 4 structures within prescribed fire units were completed on

- 5 acres around Coyote Creek barn in the Mainstem unit
- 1 acre around Coyote Creek cabin in the Coyote Creek unit
- 11 acres around Elk Camp housing in the Lower Elk Camp unit
- 10 acres around Lyons Ranch between the Lyons Ranch and Upper Lyons prescribed fire units.

Under Alternative 2 (2005 FMP, no action), prescribed fires would be conducted in these areas within the boundaries of the respective prescribed fire units.

2005 FMP Historic Structure Protection

Annual historic structure fuel reduction projects were completed around the perimeters of eight structures. Under Alternative 2 (2005 FMP, no action), annual fuel reductions would continue around all eight structures. Fuel reductions are proposed for seven of these structures under the 2010 FMP proposed action. The eighth structure, the Lane Ranch house and garage in the Lower Elk Camp prescribed fire subunit, is covered under preparations for the Lower Elk Camp prescribed fire unit under the 2010 FMP proposed action.

2005 FMP Prescribed Fire

The 2005 FMP included 29 prescribed fire units, including the prescribed fire unit in Boyes Prairie in Prairie Creek Redwoods State Park, totaling 4,600 acres. The 2010 FMP proposed action includes 36 prescribed fire units totaling 6,800 acres, most of which are the same as those from the 2005 FMP. Prescribed burns were conducted in 20 of the 29 units established in the 2005 FMP. Burns were not carried out in Childs Hill, Lower Counts Hill, DeMartin, Dooleyville, Eastside, Flint Ridge, Major Creek, Mid Basin, or Tick units. The Flint Ridge unit was inspected and determined to be unsuitable for prescribed fire because the area has become overgrown with invasive Himalaya blackberries. Under Alternative 2 (no action=2005 FMP), there would be 27 prescribed fire units because Flint Ridge has been determined unsuitable for prescribed fire and the Boyes Creek unit in Prairie Creek Redwoods State Park is not covered under the environmental assessment for the 2010 FMP for national park lands. All other units from the 2005 FMP (Alternative 2) are included in the 2010 FMP proposed action (Alternative 1) with the exception of the Boyes Prairie unit in Prairie Creek Redwoods State Park and Flint Ridge unit.

2005 FMP Preparation for Suppression

Preparation for suppression under the 2005 FMP involved placement of 2,500 gallon holding tanks to supply water for fire engines and waters tenders, and maintenance and vegetation clearing around existing ponds for access by vehicles and equipment.

Holding tanks have been installed at

- the A-9 deck;

- mile 14 on the West Side Access Road;
- the intersection of Holter Ridge and Geneva Roads;
- mile 2 on the Tall Trees Access Road (C Line); and
- the intersection of Ranch Road and Mid-Basin East Road in Coyote Creek watershed.

The tanks on the A-170 Road and on mile 2 on the K&K Road were not installed as proposed under the 2005 FMP. Installation on the A-170 tank is proposed under the 2010 FMP and would be included in Alternative 2 (2005 FMP, no action). The K&K Road tank is not proposed for installation under the 2010 FMP proposed action and would not be included in Alternative 2 (2005 FMP, no action).

The M-Line Pond was prepared for access by helicopters and ground-based equipment. The Upper Elk Camp pond was prepared for access by ground-based equipment. Maintenance of these ponds is also included in the 2010 FMP proposed action and under Alternative 2 (2005 FMP, no action).

Differences Between 2005 FMP (No Action) and 2010 FMP Proposed Action

New additions to the fire management program and projects proposed in the 2010 FMP proposals (Alternative 1, proposed action) that were not in the 2005 FMP (Alternative 2, no action) are 8 new prescribed fire units; a new shaded fuel break; and 2 new locations for 2,500 gallon water tanks. Most other actions that were approved under the 2005 FMP that were not completed that are being carried over as elements of the 2010 FMP proposed action. Actions approved in the 2005 FMP that would not be included in the no action alternative (Alternative 2) are prescribed fire in Flint Ridge; installation of a water tank on the K&K Road; and mechanical fuel reduction on 300 acres of a Monterey-knobcone pine plantation on the west side of Redwood Creek. These projects that were part of the approved 2005 FMP were determined to be unnecessary (Flint Ridge prescribed fire); too costly for the resource benefit obtained (Monterey pine fuel reduction); or the location was changed (K&K tank).

Prescribed Fire Units

Eight new prescribed fire units proposed under the 2010 FMP as Alternative 1 (the proposed action) are located at

- C-10
- Davison Ranch
- Enderts Beach
- Lower Gans Prairie
- Holter Ridge Beargrass site
- Lagoon Creek
- Upper K&K
- Wildcat

The Airstrip and Dolason prescribed fire units from the 2005 FMP have been expanded to upper and lower units for both Airstrip and Dolason units, following mechanical treatments and pile burning in 2007 to reduce high fuel loads adjacent to prescribed burn units.

The Little Bald Hills prescribed fire unit covered 50 acres under the 2005 FMP. Under the 2010 FMP proposed action, the prescribed fire unit boundaries have been expanded to 1,470 acres, with a proposed rotation of 50-acre burn blocks within the unit boundaries over the 5 year life of the 2010 plan (250 acres located within the 1,470 acres).

Shaded Fuel Breaks

A 25-acre fuel break around the Howland Hills Outdoor School complex and access road is proposed under the 2010 FMP proposed action. Fuel breaks around the Wolf Creek and Hiouchi fire caches and park housing areas that were initiated under the 2005 FMP would be completed under the 2010 FMP proposed action. All fuel breaks would be maintained under both Alternative 1 (2010 FMP proposed action) and Alternative 2 (no action, 2005 FMP).

Water Tank Installation

Water tanks would be installed under the 2010 FMP proposed action at Holter Ridge Road South and the Little Bald Hills; these were not planned in the 2005 FMP (Alternative 2, no action). Tanks planned under the 2005 FMP at two locations (mile 3.5 on Bridge Creek Ridge Road and A-170) that were not placed would be carried over to the 2010 FMP proposed action.

Ponds

Preparation and maintenance for access by ground-based equipment to the Lower Elk Camp and Coyote ponds were included in the 2005 FMP (Alternative 2, no action) but not completed. Preparation and continued maintenance of these ponds is included in the 2010 FMP proposed action (Alternative 1).

ALTERNATIVE 3 (SUPPRESSION ONLY)

Under Alternative 3, there would be no fuels management, prescribed fire, or additional preparation for suppression actions beyond what has already been done to identify and prepare access routes and water sources.

Under Alternative 3 (suppression), the existing tanks at the West Side Access Road, Tall Trees Access Road, A-9 Deck, and the Ranch Road/Mid Basin East locations would be used, but no new tanks would be installed. These tanks were installed between 2005 and 2009, under the approved action in the 2005 FMP.

Two existing ponds on the M-Line and at Upper Elk Camp that were prepared under the 2005 FMP would be maintained as water supplies for suppression but no additional ponds would be prepared. These ponds were used for fire suppression prior to the establishment of the national park and have received occasional maintenance for park fire suppression efforts.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is the one that best meets the criteria identified in Section 101 of the National Environmental Policy Act as outlined below.

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.

- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage.
- Enhance the quality of renewable resources.

The NPS has determined that Alternative 1 (the Proposed Action, 2010 FMP) is the environmentally preferred alternative.

The proposed action includes

- prescribed fires to reduce conifers encroaching into oak woodlands and grasslands identified as significant park resources; to restore fire into a rare vegetation community where fire was a major ecological process; to reduce the threat of wildfires by reducing fuel levels; and to restore and maintain significant cultural landscapes created historically by human-set low-intensity fires.
- fuel management projects to reduce high fuel levels along the park boundary and in areas where human safety and property are at risk.
- fuel management to reduce fuels around historic structures to protect the structures.
- preparation for suppression of wildfires that could damage park resources and threaten human life and safety.

These actions provide the greatest long-term protection to significant park resources including old growth redwood forests, streams, threatened and endangered species that occupy the forests and streams, oak woodlands and grasslands, and cultural resources that are listed on or eligible for listing on the National Register of Historic Places. These actions have some direct adverse effects, primarily from smoke and burned vegetation associated with prescribed fire, but the adverse effects are very short-term and localized. The long-term effect of fire suppression has been to allow fuels to build up to levels that would create an intense fire if a wildfire ignites. Although suppression of wildfires would continue under both the proposed action (Alternative 1 2010 FMP) and no action (Alternative 2, 2005 FMP), the proposed action includes more actions to reintroduce fire through prescribed burning to areas where fire has been excluded and to reduce heavy fuels in more areas where wildfires would cause environmental and property damage.

The proposed action would provide the best protection for park resources from wildfires by mechanically reducing fuels where prescribed fires cannot be used because fuel loads are currently too high or where a wildfire would move quickly into or out of the parks before an effective suppression effort can be initiated. Prescribed fires would also reduce fuels but prescribed fire is focused on restoring a major ecological process acting on native plant species and plant communities that evolved with more frequent and less intense fires. Prescribed fire in the Bald Hills would also restore and maintain the cultural landscape created over centuries from intentional burning by local American Indians, as well as begin to restore populations of plants traditionally used by American Indians.

The no action alternative (Alternative 2, 2005 FMP) is not the environmentally preferred alternative because it would not achieve fire management goals to as great an extent as the proposed action. The no action alternative does not include as many prescribed fire units. In particular, the Little Bald Hills prescribed fire unit under the no action alternative is not as large as under the proposed action.

Low-intensity fire is needed in the Little Bald Hills is to restore and maintain the unique Jeffrey/knobcone/Idaho fescue plant community that is also the only habitat in the park for the rare Mardon skipper butterfly, whose southernmost known location is the Little Bald Hills.

Alternative 3 (suppression only) is not the environmentally preferred alternative because it does not include actions to be taken to reduce the chance of wildfires, reduce the risk of a major or catastrophic wildfire, manage the parks as ecological communities, or manage the parks as an interrelated complex of natural and cultural resources. The following actions that are included in the proposed action (Alternative 1, 2010 FMP) or Alternative 2 (2005 FMP, no action) would not be undertaken under the suppression only alternative:

- mechanical reduction of fuels to reduce the hazard from excessive high fuel build-up;
- preparation for suppression by providing water sources or ensuring that strategic roads can be used for equipment on short notice;
- prescribed fire in ecological communities and vegetation types where fire was an ecological process that shaped the community structure and composition;
- prescribed fire as a cultural or historical component needed to sustain important cultural traditions and food sources.

AFFECTED ENVIRONMENT

Climate

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

Temperatures vary only slightly from summer to winter along the coast. Inland areas such as Jedediah Smith Redwoods State Park and the Redwood Creek basin have a greater fluctuation in temperatures. Mean daytime temperatures near Orick at Prairie Creek Redwoods State Park are 47°F in January and 59°F in June. Temperatures above 90°F or below freezing are rare in the redwood forests but more common in inland areas such as the Bald Hills and Little Bald Hills.

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

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

Air Quality

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

Air quality in RNSP is considered good to excellent because of the low population, scarcity of pollutant sources, and prevailing westerly ocean winds. Local views and scenes are often impaired by fog, rain, low clouds, salt spray haze, and natural forest haze inversion.

The parks are assigned to the North Coast Air Basin by the California Air Resources Board, which is under the jurisdiction of the North Coast Unified Air Quality Management District. Federal standards

are consistently achieved, including those for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead. The most significant air pollutant in the parks is PM10 (particulate matter less than 10 micrometers in diameter), which is primarily from widespread nonindustrial burning such as burn barrels, woodstoves, and vegetation burn piles industrial burning of timber harvest slash piles; and prescribed burning on federal and state lands. In the past, total suspended particulates exceeded air quality standards, but improved technology, better use of materials, and fewer sawmills (and especially their tepee burners) in the region have resulted in a reduction in suspended particulates.

A particle monitor in the parks measures fine particle mass (matter less than 2.5 micrometers in diameter), sulfates, nitrates, and aerosol elemental composition. An ozone and meteorological monitoring site operated in the parks between 1987 and 1995. Other monitoring stations are in Crescent City and Eureka.

Geology, Topography, and Soils

Geology—The parks are underlain primarily by Jurassic-Cretaceous aged rocks of the Franciscan assemblage, a collection of sandstone, siltstone, schist and minor amounts of conglomerate with isolated exposures of chert and volcanic greenstones. The Franciscan complex is bounded on the west by the Cascadia subduction zone and on the east by the South Fork Mountain fault (or Coast Range thrust). The Prairie Creek area is underlain by Plio-Pleistocene coastal plain sediments of the Prairie Creek Formation. Quaternary alluvial and marine deposits blanket the stream valleys and coastal areas of the parks.

The California coast is tectonically very active, and its complex geology and topography are controlled by movement along faults and crustal plates. Most of the land encompassed by the parks has experienced recent tectonic uplift which is manifested in steep slopes along major streams. The topography of the parks is influenced by several north-northwest trending faults.

Mesozoic-age (Jurassic to Cretaceous) rocks of the Franciscan complex underlie most areas of RNSP. The Franciscan complex was laid down on the ocean floor as deposits of sand and mud about 150 to 100 million years ago. These deposits were carried eastward on the oceanic plate, accreted to the North American continent, and eventually uplifted to form the Coast Range. Through time, folding and faulting further complicated the Franciscan complex rocks. Bedrock beneath the parks is mostly composed of sedimentary graywacke sandstone, mudstone, metamorphic schist, and minor amounts of conglomerates and mélangé. Other deposits include Tertiary marine deposits and serpentinites in the Little Bald Hills area just east of Crescent City. Pliocene/Pleistocene cobbles, sands, and silts of the Prairie Creek formation are thought to have been deposited in a river delta laid down by the Klamath River more than two million years ago. Quaternary alluvial and marine deposits blanket the stream valleys and coastal areas of the parks.

Many areas of the parks are susceptible to mass wasting processes such as debris slides and avalanches, block falls, shallow and deep-seated landslides, streamside landslides, and earthflows. During periods of high precipitation, slope failures commonly occur in watersheds impacted by logging activities and along steep terrain throughout the parks.

Topography—Topography refers to the shape and relief of the surface of land, ranging from flat to rolling to mountainous. Rapid tectonic uplift; abundant, intense rainfall; and sheared bedrock make much of the parks highly erodible, deeply incised, and generally rugged. Topography affects fire behavior, fuels, and local weather. Steep slopes predispose an area to rapid uphill fire growth and create firebrands that roll downhill. Drier sites at tops of ridges or on south-facing slopes are more susceptible to fire.

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

For the most part, the soils in the parks are well developed because the mild wet climate has caused a high degree of weathering of the underlying materials. Most of the soils have strongly developed surface horizons that are rich in organic matter and nutrients, particularly in areas that have coniferous forests, oak woodlands, and prairies. These soils are moderately coarse textured and have infiltration capacities but possess little cohesion and very low shear strength. The high organic matter content contributes to the high natural growth rate of the vegetation in these plant communities. The steep terrain, rainy climate, and deep, medium-textured soils make the area very susceptible to erosion.

Water Resources

RNSP includes a wide variety of aquatic habitats and wetlands, ranging from headwater streams, large rivers, ocean shoreline, and deeper ocean waters. Abundant rainfall, a temperate climate, and varied topography create ideal conditions for the development of many different types of wetlands. Surface water resources in RNSP consist of saltwater (Pacific Ocean), freshwater (streams and rivers), and transitional areas (estuaries and lagoons). Groundwater aquifers are few in number and small in supply in the parks because most of the area is mountainous and is underlain by bedrock—conditions that do not provide for groundwater storage.

Ocean waters and groundwater aquifers are not likely to be affected by fire management. Of the surface water and groundwater resources, the rivers, creeks, streams, coastal lagoons, and two artificial impoundments that have well-developed associated wetlands have the potential to be affected by fire management activities.

There are about 35 miles of Pacific Ocean shoreline within the parks. At the northern end of the parks, Crescent Beach is a gently sloping coastal plain. Less than a mile south at Enderts Beach, the bluffs rise abruptly to steep cliffs that are typical of most of the parks' shoreline. Steep cliffs continue to the south, with sandy beaches reappearing again at Gold Bluffs Beach and Freshwater Spit.

Three large riverine systems drain most of the park and have cut deep gorges through forested mountainous terrain—the Smith River in the northern part of the parks, the Klamath River in the center, and Redwood Creek to the south.

The Klamath River, the largest river in the north coast area with a drainage area of 15,000 square miles in California and Oregon, flows through a narrow strip of parkland before entering the Pacific Ocean.

The Smith River flows through Jedediah Smith Redwoods State Park at Hiouchi. Mill Creek is a major tributary of the Smith River that joins the Smith on the downstream side of Stout Grove across the river from Hiouchi and the Jedediah Smith state park campground.

Redwood Creek, the lower third of which is in the national park, is the southernmost park stream to enter the ocean. Prairie Creek is the largest tributary of Redwood Creek and the last to join Redwood Creek about three miles upstream of the mouth of Redwood Creek. Coyote Creek, Copper Creek, and Tom McDonald Creek are large tributaries that join Redwood Creek within the park boundary. Lost Man and Little Lost Man in the national park and Boyes Creek in Prairie Creek Redwoods State Park are major tributaries of Prairie Creek within the parks.

Annual stream flows in the parks are highly variable due to seasonal precipitation in the region. The rainy season typically extends from October through April, but most of the precipitation and subsequent high flows occur between November and March, with less precipitation and corresponding low flows during the summer and fall.

There are no natural ponds or lakes within the parks, although lagoons, sloughs, and marshes occur as a result of oceanic and tectonic processes. The western half of the waters and shoreline of Freshwater Lagoon, southwest of Orick, are within the park boundary; this is the only large lagoon in the parks. There are several smaller man-made stock and fire suppression ponds in the Bald Hills and on the west side of the Redwood Creek basin along the West Side Access Road, and two ponds associated with former lumber mills.

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

Redwood Creek is currently listed under the Clean Water Act Section 303(d) for sediment and temperature impairment. The Environmental Protection Agency adopted a TMDL for sediment in Redwood Creek in 1998 (USEPA 1998). Beginning in 1998 in conjunction with the EPA, the North Coast Regional Water Quality Control Board formulated a “Water Quality Attainment Strategy and Implementation Plan” to achieve the water quality objectives for the Redwood Creek watershed.

The TMDL identified ten sources of sediment delivery for the Redwood Creek watershed. Two sources of naturally occurring sediment delivery are earthflows/block slides and tributary landslides. The other eight are controllable to some extent: 1) erosion associated with roads, skid trails, and landings; 2) gully erosion; 3) bare ground erosion associated with human activities; 4) stream bank erosion associated with human activities; 5) tributary landslides (road related); 6) tributary landslides

(harvest related); 7) mainstem landslides, many of which are natural, and the delivery of sediment may be controllable to varying degrees; 8) debris torrents. Accelerated erosion from land use practices and other causes is impacting the migration, spawning, reproduction, and early development of cold water anadromous fish including coho salmon, Chinook salmon, and steelhead trout.

Floodplains and Wetlands

Streams in the parks are typically small and steep and do not have well-developed floodplains. However, there are floodplains near the mouths of the larger rivers and in areas that are less steep (Klamath and Smith Rivers and Redwood, Mill, and Prairie Creeks).

Wetlands are defined by the National Park Service as any area classified as wetland habitat according to the USFWS's Classification of Wetlands and Deepwater Habitats of the United States. Wetlands types under this classification are referred to as "Cowardin wetlands" after the author of the classification report (Cowardin et al, 1978). According to this definition, a wetland has at least one of three attributes: undrained hydric soils, predominantly hydrophytic vegetation, or, if the substrate is nonsoil, the area is saturated with water or covered with shallow water at some time during the growing season of each year.

Riparian zones along streams are the wetland type most likely to be affected by fire management activities associated with suppression of wildfires. Other naturally-occurring wetlands such as estuaries at the mouth of Klamath River and Redwood Creek are located in coastal areas not susceptible to wildfires.

Vegetation

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

Coast redwoods are endemic to California and southwestern Oregon. Redwoods are well known as the world's tallest trees. Coast redwoods over 200 feet in height are common and many are over 300 feet. Redwood trees have been known to live over two thousand years.

Coniferous Forests—Old-growth coastal redwood forest dominated by coast redwood (*Sequoia sempervirens*) and Douglas-fir (*Pseudotsuga menziesii*) remains on approximately 39,000 of the 130,000 acres in RNSP. The three state parks within the RNSP boundary contain the majority of old growth redwood forests. The national park includes about 19,640 acres of old growth forest, not all of which are redwood-dominated. The Little Lost Man Creek watershed in the southern part of the national park contains approximately 2,190 acres of old-growth forest, the greatest percentage of total watershed area (91%) remaining as old-growth for the major tributaries of Redwood Creek.

Associated species depend on local conditions such as whether a site is upland, riparian (streamside), alluvial (along a floodplain), or close to the ocean. Other coniferous trees are Douglas-fir, grand fir (*Abies grandis*), Sitka spruce (*Picea sitchensis*) in lowland and coastal areas, and western hemlock

(*Tsuga heterophylla*) in moist habitats. Conifers other than redwood may be the dominant species in some forest stands where soil, temperature, moisture, and ocean salt-spray do not favor redwoods.

Hardwood species are generally overtopped by conifers in redwood forests but occasionally dominate a stand. Major hardwoods are tanoak (*Lithocarpus densiflora*), Pacific madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), California bay laurel (*Umbellularia californica*), and red alder (*Alnus rubra*). All these hardwoods occur in both riparian and upland areas. Giant chinquapin (*Chrysolepis chryophylla*) and western redcedar (*Thuja plicata*) are encountered throughout park forests.

The dominant understory species of the redwood forest are oxalis (*Oxalis oregana*) and sword fern (*Polystichum munitum*). Other common understory plants are Pacific rhododendron (*Rhododendron macrophyllum*), evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), and several types of berry (native *Rubus spp.* and *Ribes spp.*). Middle and upper slope positions are characterized by evergreen shrubs (salal, rhododendron, and huckleberry).

Second growth forests in the park are dominated by Douglas-fir which re-established more quickly than redwoods after logging. Residual old-growth trees of various species are common throughout some of logged stands. The understory is generally sparse to non-existent, with pockets of dense understory near streams, roads, or forest gaps where sunlight penetrated.

Although the old-growth and second growth forests are often too shady for most nonnative plant species, dense infestations of English ivy occur some forest areas. Common exotic species found along the roads and in open areas like the Bald Hills include Scotch broom (*Cytisus scoparius*), hairy cat's ear (*Hypochaeris radicata*), bull thistle (*Cisium vulgare*), Canada thistle (*Cisium arvense*), pampas grass (*Cortaderia jubata*), Himalaya blackberry (*Rubus armeniacus*), poison-hemlock (*Conium maculatum*), and foxglove (*Digitalis purpuraria*).

In the Redwood Creek basin, dry forest types occur along ridges from Slide Creek to Coyote Creek. The mixed evergreen forest found inland from the redwood forest is dominated by Douglas-fir, tanoak, and madrone. California bay, bigleaf maple, chinquapin, canyon live oak (*Quercus chrysolepis*), and poison oak (*Toxicodendron diversilobum*) are also common in this forest type.

Fire Ecology in Coastal Redwood Coniferous Forests—Fire has had an ecological role in the redwood forest type with mean fire interval estimated to be from 17 to more than 350 years depending on stand location. Mature redwoods are considered very resilient to fire. The thick bark, great height, and ability to sprout from the root crown or from dormant buds under the bark of the bole and branches are adaptations that allow redwoods to survive cool to hot fires.

Coastal Douglas-fir is more fire resistant than many of its associates and can survive moderately intense fires. Thick, corky bark on the lower bole and roots protects the cambium from heat damage. In addition, the tall trees have their foliage concentrated on the upper bole, which makes it difficult for fire to reach the crown; however, it should be noted that trees are typically not free of lower branches up to a height of 33 feet until they are more than 100 years old.

In the redwood forests in RNSP, the fire return interval can vary from ten to more than 250 years, depending on stand location. Douglas-fir is a minor component of old growth redwood forests in valley bottom areas but are co-dominant with redwood on the ridges. In the interior ridges of Redwood Creek, Douglas-fir is the dominant conifer in the mixed evergreen hardwood forests. The fire return interval in these stand likely occurred at frequencies of 5-25 years.

In the logged second growth stands within the park planted in aerial seeding programs, Douglas-fir is a dominant species. Because these stands have no natural precedence in the coastal redwood region, there is no natural fire regime from which to predict the ecological succession. In 2003, a 300-acre wildfire burned in a 35-year-old second growth stand dominated by Douglas-fir. Monitoring has been initiated to follow long-term fire effects.

Research in the Pacific Northwest has shown that crown fires commonly kill all Douglas-fir trees over large areas. Hot ground fires that scorch tree crowns and char tree boles kill variable proportions of coast Douglas-fir. Rapidly spreading ground fires tend to inflict more damage to Douglas-fir crowns, while slow spreading ground fires damage the bole and can kill trees through cambial heating. Crown scorching from summer fires is more damaging than late summer or fall fires because more buds are killed. During late summer the buds are set and subsequent-year needles are well protected. Seedlings and saplings are susceptible to, and may be killed by, even low-intensity ground fires. Temperatures higher than 140°F are lethal to Douglas-fir seeds. Thus most seeds on the forest floor will be destroyed by fire. Crown fires will kill seeds in green cones; however, green cones are relatively good insulators and are not highly flammable, and fires that are not excessively hot often only scorch the cones. Seeds can mature in scorched cones on fire-killed trees, and later disperse onto the burned area.

Western hemlock is a very shade-tolerant conifer generally considered a climax species either alone or in combination with its shade-tolerant associates, but it can be found in all stages of forest succession after a fire. It is an aggressive pioneer because of its quick growth in full overhead light and its ability to survive on a wide variety of seedbed conditions. It also invades seral stages of forest succession after a forest canopy has formed.

Western hemlock has a low degree of fire resistance because of its thin bark, shallow roots, highly flammable foliage, and a low-branching habit. Western hemlock tends to form dense stands and its branches are often lichen-covered, which further increases its susceptibility to fire damage. Like most conifers, hemlock does not resprout but is able to reestablish abundantly following fires, especially where a substantial canopy remains. Hemlock is most abundant on the intermediate to moist sites and is successful as an understory tree, becoming best developed in canopy openings until killed by fire.

Grand fir is a large fast-growing evergreen conifer moderately resistant to frequent surface fire. Its seedlings become established in the understory in light litter, and on mineral soil on steeper slopes. Grand fir also establishes in light to moderate understory shade and in small forest openings.

Tanoak is a slow-growing, shade-tolerant evergreen hardwood tree. A shrubby growth form of tanoak found in the Little Bald Hills is a stunted form typically associated with chaparral vegetation.

Tanoak is a long-lived species capable of establishing beneath a full canopy of hardwoods or conifers. Once established, tanoak is extremely persistent on a site despite low light levels. Whereas tanoak may attain tree size where gaps develop in the overstory, suppressed tanoak individuals are shrub-like, maintaining themselves through periodic diebacks. Prolonged periods without disturbance permit tanoak seedlings to steadily accumulate in the forest understory.

Tanoak is a fire-sensitive species. Aboveground portions are extremely susceptible to fire mortality. The thin bark provides little insulation from radiant heat which usually kills the cambium around the base of the stem. As a result, low-intensity ground fires readily top-kill tanoak seedlings and sapling-sized stems. Larger, thicker barked trees occasionally survive light underburning. Long-term survival is most likely in young, vigorous trees where bole wounds tend to heal over rapidly. Crown fires kill the aerial portions of all tanoak, regardless of age or size. Forest openings created by fire increase light, releasing the tanoak to grow taller.

Tanoak resprouts following fire via dormant buds located on an underground regenerative organ known as a burl or lignotuber. Stored carbohydrates in the burl and an extensive taproot system aid in a rapid and aggressive postburn recovery. Resistance to low intensity burning is increased in older individuals where the bark may be from one to three inches thick. Unless fires are particularly severe, nearly all tanoak resprout to some extent during the first postburn growing season. The essentially pure, dense, even-aged sprout stands which frequently result following fire provide the mutual shading necessary for optimal tanoak development. In RNSP, tanoak is most abundant on the park's intermediate to dry sites, but occurs in many different vegetation communities under different microclimates. It reaches its greatest age in RNSP on sites adjacent grasslands and woodlands that experienced frequent, light understory burning by American Indians.

Little Bald Hills Dry Forests and Grasslands and Fire Ecology—The Jeffrey pine/chaparral/knobcone pine vegetation type includes several distinct vegetation types throughout the Little Bald Hills, an area of about 1,500 acres in the north eastern portion of the park. Despite almost 100 inches of annual precipitation here, these communities have sparse vegetation due to serpentine soils, which have high concentrations of heavy metals such as magnesium and few nutrients available for plants because of high pH and poor water holding capacity. These harsh growing conditions have resulted in the development of specialized plant communities with many unique plant species.

The driest ridgetops are occupied by widely scattered Jeffrey pine (*Pinus jeffreyi*) with an understory of Idaho fescue (*Festuca idahoensis*). The fringes of this area are being rapidly encroached by Douglas-fir and the open areas in the driest sites are diminishing due to regeneration of Jeffrey pine. A chaparral vegetation type is located downslope of the Jeffrey pine and is dominated by manzanita (*Arctostaphylos spp.*), golden chinquapin, rhododendron, huckleberry oak (*Quercus vaccinifolia*), a shrubby form of tanoak (*Lithocarpus densiflorus var. eisenii*), and other evergreen shrubs,

interspersed with stands of knobcone pine. Port-Orford-cedar (*Chamaecyparis lawsoniana*) is found in the Little Bald Hills in the Jeffrey pine/chaparral/knobcone pine vegetation type.

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

Knobcone pine is an obligate fire species. Its closed-cone habit makes it dependent upon stand-replacing crown fire for reproduction. Continued production and accumulation of cones throughout the life of a tree assures that large quantities of seed are released when fire opens cones. The open, multi-trunked growth form of knobcone pine promotes fire crowning (Vogl 1973). Fire creates seedbed conditions favorable for germination and seedling recruitment. It temporarily raises soil pH and increases soil nutrient content, particularly phosphorus and nitrogen. A longer-term benefit of fire to the species is the retrogressive role it plays in soil genesis. By removing litter and ground cover vegetation, fire contributes to soil erosion. Wind-felling of fire-killed trees results in further churning up of nutrient-deficient soils. Most plant species cannot compete with knobcone pine on such poor sites. The discontinuous nature of serpentine prevents all the pines in an area from being killed by any one fire.

Crown fire kills all size classes of knobcone pines and vaporizes the resin, sealing their cones. The effect of surface fires on mature trees is undocumented. The thin bark probably provides little protection from all but low-severity surface fire. Saplings are killed by surface fire. Cones are extremely fire resistant and are seldom consumed by fire (Vogl 1973). Fire-opened cones remain attached to standing dead trees. Released seed quickly germinates with late winter or early spring rains. Seedlings continue to establish over a period of several years as cones slowly open and release seeds. Fire is essential for the completion of knobcone pine life cycle. Cones of senescent or dead trees must be opened by fire to perpetuate the groves before trees succumb and add the unopened cones to the decomposing litter.

Chaparral, knobcone pine, and Jeffrey pine woodlands in association with Idaho fescue occupy approximately 300 acres in the Little Bald Hills. The driest ridge top sites are occupied by Jeffrey pine/Idaho fescue grasslands while downslope, chaparral, dominated by manzanita, golden chinquapin, rhododendron, dwarf oaks and other evergreen broadleaved shrubs, is interspersed with stands of knobcone pine. Little is known about its fire history other than the area last burned about 1940.

Bald Hills Oak Woodlands and Grasslands and Fire Ecology—The Bald Hills, a complex mosaic of vegetation types including grassland, Oregon white oak (*Quercus garryana*) woodlands, and coniferous forest, is the most extensive grassland/woodland vegetation type in the parks. The Bald Hills include about 1,700 acres of Oregon white oak woodland and 2,500 acres of grassland along the

ridgetops dividing the Redwood Creek and Klamath River drainages. These woodlands and grasslands are vulnerable to encroachment by conifers, primarily Douglas-fir. Prescribed burning to kill young encroaching conifers and other woody species has been one of the principle tools used by the NPS to manage the prairies since the mid-1980s, with a more extensive program of prescribed fires and cutting to remove encroaching Douglas-fir and restore fire as a process beginning in the early 1990s.

Oregon white oak is the dominant oak species in the Bald Hills with scattered individuals of California black oak. Oregon white oaks occur from 3,000 feet elevation at Schoolhouse Peak to 700 feet along Redwood Creek. California bay, madrone, and big-leaf maple can be found near rock outcrops and stream channels. Shrubs can also be found growing in rockier sites, while in most other areas, the understory is typically herbaceous and dominated by grasses and forbs.

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

Park managers believe that prairies and oak woodlands existed in the Bald Hills prior to the arrival of American Indians 5,000 years ago, although the extent and distribution is unknown. The contemporary extent of the Bald Hills grasslands is likely determined by a number of factors, including soil type, slope, aspect, landform position, present and past climate, plant succession processes, and fire history.

Humans probably had a profound influence on the ecological processes that formed and maintained the Bald Hills grasslands over thousands of years. Before the arrival of Euro-Americans around 1850, American Indians traditionally used fire to increase the amount of seeds, basketmaking materials, and forage for deer and elk. The Klamath Indians around Weitchpec, ten air miles east of the park, specifically burned the grasslands to keep the Douglas-fir from encroaching (Thompson 1916). There is evidence that the Chilula Indians repeatedly burned the oak woodlands prior to the mid-1800s (Gates et al. 2002). Oregon white oak was subjected to a fire regime of low-severity surface fires occurring every few years that probably killed encroaching trees and shrubs (Arnold 1964). A study in the Oregon white oak woodlands of Humboldt Redwoods State Park south of RNSP revealed a history of fire every 7.5-to-13.3 years during the pre-settlement era (Stuart 1987). Douglas-fir were held in check for many millennia by frequent fire and low intensity anthropogenic impact. The largest grasslands in the Bald Hills were probably contiguous until intentional burning ceased, allowing conifers to encroach upon the grasslands and creating stands of coniferous forests that separate the grasslands from one another. It is estimated that the Bald Hills complex is three-quarters of the size it was prior to 1850 (Reed and Sugihara 1987; Sugihara and Reed 1987a, 1987b). Although conifer invasion is a natural process (Zinke 1977), it appears to have accelerated since 1850. This is probably due to a combination of reduced fire frequency from cessation of burning by American Indians and early ranchers, road building, exotic species proliferation, and introduction of

livestock that disaggregated the dense sod and allowed conifers to become more easily established. Associated changes to animal populations, such as larger numbers of small mammals, may be contributing to increased exposure of mineral soil, creating an abundance of receptive sites for Douglas-fir seeds.

Frequent fire resulted in the open savannas typical of pre-settlement condition in the Bald Hills of RNSP (Sugihara et al. 1982). Three general stand types are found within the park today, open grown, large single stem trees (savanna type), closed-canopy-multiple bole, and closed-canopy-single stem (oak forest type). Based on observations of vigorous oak bole and root sprouting following a 1981 prescribed burn, it appears that the dense (4,500-12,000 stems per hectare) closed-canopy-single stem stands may be an early postfire successional stage. Without follow-up burning, this sprouting response may force oak stand development away from the more typical savannah form into the oak forest form. A study of similar oak woodlands proposed that the most probable cause for the conversion of oak savanna to oak forest in Oregon's Willamette Valley is interruption of ground fires, both those set by American Indians and wildfires, which were much reduced in size and effect, allowing dense growth of Oregon white oaks to become prevalent (Thilenius 1968).

Although fire can kill individual oak trees, it is important for continuation of oak stands under natural conditions, especially in areas where inherently taller, more competitive conifers are invading (Plumb and McDonald 1981; Sprague and Hansen 1946; McCulloch 1940; Silen 1958; Taylor and Boss 1975). Because of rapid sprout growth, the oaks capture the area and are perpetuated. In the Bald Hills, oak woodlands such as the Schoolhouse Peak prescribed burn unit that have been burned on a three-to-five year rotation are free of encroaching conifers and do not exhibit the dense, post-fire closed-canopy-single-stem form typical of more intensely burned woodlands (personal observation, Leonel Arguello, RNSP supervisory botanist). Prescribed burns conducted in the Bald Hills to capture seedling conifers encroaching into the woodland are typically cool, leaving a mosaic of burned and unburned vegetation. A few areas of oak woodlands burned in the park prescribed fire program have experienced high intensity burns that resulted in top kill of oak trees. These hotter fires were the result of elevated fuel loadings that resulted from cutting encroaching conifers and leaving them on the ground. A large percentage of these top-killed oak trees have resprouted basally or epicormically (Arguello, personal observation).

Prescribed burning in the Bald Hills has not caused overt landscape-level changes in oak woodland canopy structure. Park fire effect studies show that all shrub species, even when top-killed, sprouted following the burns. Douglas-fir less than ten feet tall were killed when at least 70% of the foliage was scorched. All sampled oaks under ten feet were top-killed but sprouted whereas oaks taller than ten feet suffered little damage and produced few sprouts. The amount of sprouting varied with fire intensity, size, and whether the tree was alive or dead at the time of the burn or was killed during the fire. Little sprouting was noted after a low intensity prescribed burn but considerable sprouting occurred following two higher intensity fires. The net effect of fire on stand structure appears to be reduction in small size classes and the formation of a new size class by fire induced sprouting. Long-term evaluation of seedling and pole-sized tree maturity is part of the vegetation management program in the Bald Hills.

All burning conducted in the park occurs after dormancy in the herbaceous flora, generally September and October. Results indicate that annual grass and forb diversity increased for one or two seasons after a prescribed burn then declined to pre-burn levels (NPS unpublished data on file, Orick, CA). Targeted exotic species such as Scotch broom are negatively impacted by burning, although the seed bank continues to provide an available source of scotch broom seedlings. Encroaching conifers are kept in check by repeated prescribed burning. Perennial grasses and forbs have been essentially unaffected by the burns. Spring burning in the Bald Hills has not been conducted after research indicated a sizeable reduction in post-fire frequency and cover for native grassland species (Arguello 1994).

Coastal Grassland, Coastal Strand, and Scrub—This vegetation type includes coastal strand, dune vegetation, coastal scrub, and grasslands generally occurring on a strip along the coast between the ocean and the first line of coastal mountains.

Coastal grasslands or prairies in the national park include Major Creek, DeMartin, and Crescent Beach. Some of the grasslands may be native, and others may have originated when early settlers cleared conifer forests for settlement or mining. Many of these grasslands have diminished in size as disturbance and the lack of fire have accelerated successional processes that favor woody species establishment. The dominant species in the open grasslands are perennial grasslands with shrub and/or hardwood/coniferous forest extending beyond the open grass.

Coastal vegetation is subject to wind and salt spray. The sandy soils are well drained and may not be stable. Some areas exhibit wind pruning because of strong, constant winds. Rare plants that occur along the coastal strand include pink sand verbena (*Abronia umbellata ssp. brevifolia*), Wolf's evening primrose (*Oenothera wolfii*), and the Federally-listed endangered beach layia (*Layia carnosa*).

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

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

Coastal scrub occupies a narrow strip along the immediate coast, generally on the ocean bluffs between the coastal strand and the first ridgeline. Coyote brush, salmonberry, poison oak, lupine, oceanspray and salal dominate. Occasional wind-pruned alder and Sitka spruce are also present. The scrub is often interspersed with patches of grass dominated by orchard grass, fescue or reedgrass.

All of the dominant shrub species are able to regenerate after fire through crown sprouts or root sprouts. Even if the plants are top-killed, sprouting generally begins soon after a fire. The brush cover is not only quickly replaced, but it comes back with renewed vigor. Invading trees such as Sitka spruce and alder are easily killed by fire and the scrub is maintained.

Fire History

RNSP contains ecological, archeological, and historic evidence of both prehistoric and historic fires.

Prehistoric Fire History—Fire has long been recognized as an important disturbance in coast redwood forests, but the exact nature of prehistoric fire regime or behavior is uncertain. Natural and human-caused ignition sources defined prehistoric fire regimes in lands now occupied by RNSP, and along with climate change, influenced vegetation patterns significantly. Considering natural ignitions sources only, contemporary weather patterns include moderate to strong lightning activity levels on the north coast of California occurring on an annual or bi-annual basis. Often associated with sufficient rain to extinguish fire starts, these storms are nevertheless important as ignition sources with increasing elevation and distance from the ocean. Current suppression capabilities mask the ability of fire to spread and burn significant acreage in the redwood forest. The unusual 2003 Canoe fire in Humboldt Redwoods State Park illustrated the potential for large fires in the redwood forest, although fire suppression may have contributed significantly to the final fire size. It is very likely that fires, coupled with seasonal (or more extensive) drought cycles, burned through present-day RNSP on a regular basis. Evidence of this natural fire regime is confounded by anthropogenic burning, which was a regular occurrence on the north coast as well.

Past American Indian use of fire within the present park boundary is known or inferred from many sources (Gibbs 1853, Gates et al. 2002), and can be considered ubiquitous across the landscape. American Indian burning was conducted in specific areas in the redwood region, including in and around higher elevations in the grasslands and oak woodlands above the forests. American Indians of northwestern California engaged in a variety of management practices intended to enhance the abundance and/or quality of desired species (Lewis 1993). For example, they routinely burned and then pruned hazel trees (*Corylus cornuta* var. *californica*) to improve the straightness and strength of shoots used in the construction of various implements (O’Neal 1932, Schenck and Gifford 1952). They also regularly burned the understory of productive groves of oak trees, especially tanoak, to inhibit the encroachment of conifers, facilitate acorn harvest, and reduce pest and disease problems (Lewis 1993). Discrete groves of very large, and presumably even-aged, tanoak can still be found in the Bald Hills, some with associated archaeological components, such as temporary campsites. American Indian management practices probably helped to create and maintain these groves, which, in many respects, share similarities to modern-day, intensively managed agricultural orchards (Underwood et. al. 2003).

In a study of American Indian burning practices in northwestern California, Lewis (1993) recognized two cultural landscape phenomena related to intentional burning: fire yards, openings or clearings within a forested area that are maintained by burning, and fire corridors, the fringes of ridges, trails and other linear features that are similarly maintained by fire. Fire yards attracted large game and yielded a greater abundance and diversity of economically important plants than the surrounding

forest. Burning along fire corridors was done to facilitate travel and improve resource abundance and predictability in time and space. The prairies of the Bald Hills are excellent examples of fire yards, and burning probably also occurred along several known and suspected aboriginal trails that passed through the prairies and forested areas (Underwood et. al. 2003). American Indian burning in the Bald Hills probably had a major influence on fire frequency throughout the adjacent redwood forest, but the magnitude of these burns in conjunction with lightning-caused ignitions cannot be quantified with the available data.

Quantification of pre-settlement fire regimes in RNSP through fire history research is limited at best. This research appears to indicate that on ridges, the fire return interval was likely less than 10 years (Finney 1991; Finney and Martin 1989, 1991; Brown and Swetnam 1994; Brown et al. 1999). On valley bottoms within alluvial groves, perhaps fire was more infrequent, burning once every several hundred years (Veirs 1982). Between these extremes, fires burned across the redwood forests of RNSP as often as climate and opportunity allowed, and likely varied widely in their spatial and temporal affect in any one location within RNSP.

Historic Fire Regimes—Nineteenth and early 20th century newspapers from Humboldt and Del Norte Counties document many fires that occurred in the redwoods, usually as a result of human activity and occasionally having unintended results. However, the locations and impacts of these fires are vague.

Some intentional vegetation burning by packers may have occurred near the Trinidad Trail in the Redwood Creek basin (NPS 1994b). It was probably used as a defensive measure during warfare between American Indians and settlers during the 1850s and 1860s. Settlers also used fire to maintain or expand grazing land on the periphery of natural grasslands during the 19th and early 20th centuries (Pozzi 1977; Foss 1978) for use by domestic livestock. Fire was frequently used before, during and after logging prior to World War II. These fires often escaped from the logging area and burned into uncut stands, some of which are now within the park. The old-growth redwood forest on the southwest margin of Jedediah Smith Redwoods State Park was heavily influenced by this type of burning. Almost all of the areas logged after World War II were burned to remove slash and prepare the site for seeding or planting. Some of these fires escaped, the largest of which now within park boundaries was 620 acres when contained.

During the drought years of the 1930s, human ignition is known to have produced several large fires in present park forests. One of these burned in the Bridge Creek drainage (Merrill 1978), and another burned from the Skunk Cabbage drainage east to Davison Road until it was extinguished by rain in October (Davison 1972). A third fire burned in the old-growth redwood of the present Jedediah Smith Redwoods State Park (Peacock 1984) but its precise location and area have not been determined.

Fires in chaparral east of the Little Bald Hills have burned into the pine-grassland, knobcone pine and chaparral vegetation there, as well as into the margins of the redwood forest downslope to the west. Based on tree fire scar examination and post fire regeneration, the last of these fires is known to have occurred in 1941.

For a 43-year period from 1960 through 2003, a total of 333 wildfires occurred within the boundaries of RNSP. Half of these (169 fires) were from escaped or abandoned campfires. Less than a quarter of the fires (56 fires) were caused by smoking or equipment related or of unknown origin. Fourteen percent (76 fires) of the fires were lightning caused. Nine percent (23 fires) of the fires were logged slash or debris burns that escaped and three percent (nine fires) were incendiary fires.

Between 1980 and 1991, RNSP conducted twenty-six prescribed burns totaling 427 acres (Hektner et al. 1982; Sugihara et al. 1982; RNP files). From 1992 to 2003, RNSP conducted 60 prescribed burns, totaling 9,824 acres primarily in the Bald Hills. Areas treated through prescribed fire and mechanical fuel reduction in successive years from 2005 through 2009 were 1,224; 2,416; 445; 2,307; and 688 acres.

Wildlife

Coniferous forests provide habitat for black bear, red tree vole, flying squirrels, dusky footed woodrats, and numerous other insectivores and small rodents. Birds commonly seen in this habitat type include pygmy owls, pileated and other woodpeckers, ruffed grouse, varied thrushes, winter wrens, chestnut backed chickadees, dark eyed juncos, and a variety of neotropical migrants such as warblers, flycatchers, and swallows. Rough skinned newts, Pacific giant salamanders, slender salamanders, and ensatinas are found on the forest floor. Del Norte salamanders occur in damp talus areas. Wandering salamanders live in large epiphytic fern mats in the canopy of old growth redwoods. Streams running through coniferous forests contain coastal cutthroat and resident rainbow trout, three spine stickleback, and Sacramento suckers.

Coastal areas, primarily scrub and grasslands surrounded by mixed forests, are used by Roosevelt elk, coyotes, gray foxes, and smaller species such as voles. Resident birds common in this habitat include band tailed pigeons, turkey vultures, wrentits, Allen's hummingbirds, and song sparrows. A large number of migratory birds navigate up and down the coast along the Pacific Flyway and can be found in this habitat type during the spring and fall. Small coastal streams provide habitat for northern red-legged frogs. Coastal grasslands contain the only potentially suitable habitat for the Oregon silverspot butterfly in the park.

In the Bald Hills, mountain lions, deer, bobcats, shrews, and deer mice are common. Birds include a variety of raptors such as red tailed hawk and white tailed kite as well as blue grouse, California quail, lazuli bunting, black phoebe, American goldfinch and western meadowlark. The Bald Hills oak woodlands are an important fall migratory stop-over for Lewis's woodpeckers. Amphibians are only found in the scattered springs and seeps. Gopher snakes and western fence lizards are most abundant in this area of the park.

The Little Bald Hills is a unique habitat in RNSP because of its Jeffrey pine/Idaho fescue vegetation, which provides the only habitat in the park for the rare mardon skipper butterfly. Many of the mammals found in the Bald Hills are also found here. Birds include numerous woodpecker species, pine siskin, red crossbill, and red breasted nuthatch. Amphibians are only found in the rare isolated springs and seeps near the lower slopes in this area.

The wildland-urban interface area is primarily on the edge of coniferous forest habitats and thus contains most of the species listed above. Edge specialist and exotic species are also found here such as raccoons, rats, and feral cats, Steller's jays, ravens, crows, and starlings.

Sensitive, Threatened, and Endangered Species

RNSP are occupied by or contain suitable or potentially suitable habitat for sensitive, rare, and Federally- and state-listed threatened and endangered species, or federal candidate species of plants, invertebrates, fish, and terrestrial birds and mammals that could be affected by fire management actions.

Plants

Plant species considered rare by the California Native Plant Society are found throughout the parks on coastal strands and bluffs, forested areas, grasslands, rock outcrops, stream-sides, road sides, wet meadows, and serpentine soils. Coastal bluffs, rock outcrops, streamside and riparian areas, wet meadows, bogs, and serpentine soils host the majority of rare plants in RNSP. Heavily forested areas contain few rare plant species.

The majority of rare plant species occur within the serpentine-peridotite rock belt that stretches across northern Del Norte County. The serpentine soils in the Little Bald Hills support several endemic serpentine plant species. None of these species presently merit legal protection under either the California or Federal endangered species acts. However, the California Native Plant Society lists several of these plants as species that should be watched and protected where possible so that they do not become threatened or endangered in the future.

Western Lily—The Major Creek, Lagoon Creek, DeMartin and Enderts prescribed burn units with coastal scrub vegetation may contain suitable western lily habitat. Surveys will be conducted for western lily previous to any work beginning within the prescribed burn units. If any western lily is discovered within the units then RNSP will exclude those areas from the burn units by altering unit boundaries.

Potentially suitable habitat in RNSP occurs in the Crescent Beach/Endert's Beach area south of Crescent City. At this location there are 240 acres of coastal prairie containing a wetland.

The current coastal scrub and grassland habitat is believed to be unsuitable to sustain populations of western lily, due primarily to encroachment by Sitka spruce and shrubs (L. Arguello, pers. comm.). Although a systematic survey of RNSP's coastal scrub and grasslands for the lily has not been conducted, a substantial amount of habitat, especially in the northern half of RNSP, has been surveyed in association with projects. As of this date, this species has not been documented in RNSP. No western lily surveys have been conducted in any of the five coastal scrub prescribed burn units.

Invertebrates

Mardon Skipper—Mardon skippers are butterflies found in a few small, widely distributed, isolated populations in Washington, Oregon, and far northern California. The Little Bald Hills area in RNSP

is the southernmost population known for this species and contains 376 acres of fescue grassland/Jeffrey pine woodland potentially suitable for mardon skippers. The Idaho fescue/Jeffrey pine woodland ecosystem is dependent upon disturbance such as fire to be maintained and not be overwhelmed by other species of encroaching conifers.

Mardon skippers have been discovered within all parts of the Little Bald Hills prescribed burn unit with fescue grassland/Jeffrey pine habitat during 2004 - 2009 surveys (RNSP unpub. data). Skippers appear to be relatively well distributed in pockets throughout the Little Bald Hills. The total number of mardon skippers, their complete distribution, and their reproduction are currently unknown. Their distribution and numbers within the Little Bald Hills likely fluctuates from year to year depending on climatic conditions (Kerwin 2005, S. Mattoon, pers. comm.).

The quality of skipper habitat varies within the Little Bald Hills and may or may not be occupied during any given year. By October 1 when the first prescribed burns would be scheduled, mardon skippers have most likely entered diapause and would be least susceptible to disturbance and the effects of prescribed burning during this phase of their life cycle (Kerwin 2005, Beyer and Black 2006, RNSP unpub. data on file).

Oregon Silverspot Butterfly—There are about 240 acres of potentially suitable coastal prairie habitat for Oregon silverspot butterflies in RNSP in the Crescent Beach and Endert's Beach areas south of Crescent City. Early blue violets occur in this area, as do many of the nectar sources for adult silverspots (L. Arguello pers. comm.). The coastal grasslands adjacent to Crescent Beach and Endert's Beach were surveyed at various times in the early 1990s and as recently as 2004 but this species was not detected. It is suspected that the microclimate of this area may be too cool for silverspots (S. Mattoon, pers. comm.).

Fish

Three species of anadromous salmonids belonging to three different evolutionary significant units (ESU) listed as threatened under the Endangered Species Act occur in park streams and rivers:

- California Coastal (CC) Chinook Salmon (*Oncorhynchus tshawytscha*)
- Southern Oregon/Northern California Coasts (SONCC) Coho Salmon (USDC (*Oncorhynchus kisutch*))
- Northern California (NC) Steelhead (*Oncorhynchus mykiss*)

Critical habitat is currently designated for all three species. Critical habitat is defined in Section 3(5)A of the Endangered Species Act as "...the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection". In designating critical habitat, NOAA Fisheries considers habitat elements and conditions required for all life stages of the species. In addition, NOAA Fisheries also focuses on the known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation.

Anadromous fish are fish that spend part of their lives in the ocean before returning to freshwater to spawn. Chinook and coho salmon and steelhead trout are anadromous species that occur in the Smith and Klamath Rivers, Redwood Creek, Mill Creek, Prairie Creek, and some of the tributaries of these streams. Coho salmon and steelhead trout are smaller than Chinook salmon, and are able to occupy smaller streams than Chinook salmon. Chinook salmon are found primarily in the rivers and large creeks like Redwood Creek, Mill Creek and Prairie Creek.

California Coastal (CC) Chinook Salmon—Chinook salmon historically ranged as far south as the Ventura River, California, and north as far as the Russian Far East. The California Coastal ESU (CC Chinook) occurring in Redwood Creek and other streams south of the park was listed as threatened in 1999 (USDC 1999a).

Chinook typically return from the ocean to rivers, larger streams, and larger tributaries to spawn between November and early January after three to four years in the ocean, although two-year-old male spawners are commonly observed. Winter-run Chinook constitute the main Chinook runs in RNSP streams. These fish begin their upstream migration around November, if access through the Redwood Creek estuary is possible, and have spawned and died by the end of January. Adult spring-run Chinook were observed in only one season since 1981, when the park began summer steelhead surveys, but are not typically considered to use the Redwood Creek watershed.

Juvenile Chinook salmon in the Redwood Creek and Prairie Creek watersheds do not spend time rearing in upstream areas (Anderson and Brown 1982). The sole rearing habitat for this ESU in the park is the Redwood Creek estuary. In spring, Chinook salmon fry migrate downstream to rear in the estuary before entering the ocean in the fall. Chinook salmon spawning in the RNSP tributaries may be impeded by stream barriers, but they may be able to surmount some barriers that may impede the smaller coho salmon. No Chinook have been detected during presence/absence surveys conducted at the mouth of Copper Creek (RNSP unpub. data), a steep, minor tributary to Redwood Creek that crosses a prescribed burn unit. Approximately the lower third of Copper Creek is perennial with direct connection to Redwood Creek being disrupted in the late fall dry season.

Critical habitat for CC Chinook salmon was re-designated effective January 2, 2006. Potentially suitable habitat for this ESU in RNSP occurs in the Redwood Creek basin and includes all stream and estuarine reaches accessible to the species. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of the species.

Because no Chinook have been detected in Copper Creek, it is not considered critical habitat. However, Redwood Creek into which Copper Creek empties is occupied by Chinook. Redwood Creek and its associated riparian habitat are designated critical habitat for CC Chinook.

Southern Oregon/Northern California Coasts (SONCC) Coho Salmon—Coho or “silver” salmon are found in streams and rivers throughout much of the Pacific Rim, from central California to Korea and northern Japan. Coho are anadromous and have a life history similar to Chinook salmon. However, the time coho spend in fresh and salt water is relatively fixed, compared to the more variable life history of Chinook. North of central British Columbia, coho tend to spend two years in freshwater,

while south of this point they spend only one year in the freshwater. Unlike Chinook, where most production comes from mainstem spawning areas, coho tend to use smaller streams and tributaries. North American coho spawn in tributaries from the San Lorenzo River in Monterey Bay, California to Point Hope, Alaska, and throughout the Aleutian Islands. They are most abundant in coastal areas from central Oregon to southeast Alaska.

The Southern Oregon/Northern California Coasts ESU of coho salmon (SONCC coho), including the RNSP streams, were listed as threatened in 1997 (USDC 1997).

The anadromous fish populations of Redwood Creek have experienced a substantial reduction during the last 30 years, in part due to severe flood events that moved large amounts of sediment from highly eroded hill slopes to the stream channels of the Redwood Creek basin. The total population in the Redwood Creek system may have numbered more than 2,000 adult coho; most occurred in the Prairie Creek drainage and probably originated from the Prairie Creek Hatchery (D. Anderson, unpub. field notes). Since the closure of the hatchery in 1992 the number of coho is probably much lower.

Coho salmon distribution in the Redwood Creek basin is limited to the mainstem and the larger low gradient tributaries. Coho are estimated to occupy 26 miles of streams within the Lower Redwood Creek Basin. Coho have not been found in Copper Creek but are in Redwood Creek, at least transitionally, where Copper Creek empties into Redwood Creek (RNSP unpub. data).

In southern Oregon and northern California, NOAA Fisheries has designated critical habitat for the SONCC coho between Cape Blanco, Oregon and Punta Gorda, California. The critical habitat unit is all stream and estuarine reaches accessible to the species and includes water, substrate, and the adjacent riparian zone. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho. The adjacent riparian zone is the area that provides shade, sediment transport, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter. Habitat quality in this zone is related to the quality of riparian areas, upland areas, and inaccessible or headwater or intermittent streams that provide key habitat elements, such as large woody debris and gravel, that are crucial for coho in downstream reaches (USDC 1999b). Thus, the width of the riparian zone included as critical habitat is variable depending upon consideration of these factors. Based on this definition, Copper Creek is not critical habitat but Redwood Creek is.

Northern California (NC) Steelhead—Steelhead trout were distributed historically throughout the North Pacific Ocean from the Kamchatka Peninsula in Asia to the northern Baja peninsula. Presently, the distribution extends from the Kamchatka Peninsula, east and south along the Pacific Coast of North America, to at least Malibu Creek in southern California. Steelhead likely inhabited most coastal streams in Washington, Oregon, and California as well as many inland streams in these states and Idaho. The Northern California Distinct Population Segment (NC steelhead DPS) from Redwood Creek south was listed as threatened in 2000 (USDC 2000).

Steelhead spawners are the last of the anadromous salmonid species to return to freshwater in the annual cycle, generally between January and April. Juveniles rear in the streams for one to four years before their downstream migration to the ocean. The majority of juvenile steelhead in Redwood

Creek spend their second year of life in the estuary and lower part of Redwood Creek (Anderson 1988). They reside in marine waters typically for two or three years prior to returning to the natal stream to spawn. Unlike other Pacific salmon, steelhead trout are capable of spawning more than once before they die.

Summer steelhead surveys began in the park in 1981 and survey data have indicated a continuous decline since that time. The highest number of adult fish observed during summer surveys of portions of the mainstem of Redwood Creek was 44 in the mid-1980s. No adult fish were seen in 1989 or 2001. In 2007, 12 adult fish were counted.

Winter-run steelhead numbers are higher than summer steelhead numbers. Juvenile winter-run steelhead are the most common and widely distributed fish in the Redwood Creek basin. During sampling efforts in the summers of 1980 and 1981, steelhead trout occurred in 57 of the 111 tributaries surveyed (Anderson 1988, Brown 1988). Steelhead have been present during winter stream surveys conducted since 1999 along the mainstem of Redwood Creek (flows permitting), Lost Man Creek, Little Lost Man Creek, Prairie Creek, and Bridge Creek (Holden 1999, 2002, 2004 a, b, c).

Many of the small order, high gradient tributaries to Redwood Creek provide suitable habitat for steelhead in RNSP, including the very lowest reach of Copper Creek. This reach has good riparian cover which keeps the water temperature low, and a small amount of riffles with a variety of gravel sizes, a few small pools for rearing, and instream cover provided by boulders and bedrock that provides protection for both adult and juvenile fish. There is no large woody debris because the whole watershed was clearcut in the early 1970s. Steelhead have been detected in Copper Creek near the mouth but are unlikely to occur much farther up the creek due to the steepness of the watershed (Anderson 1988, Anderson pers. comm.).

NOAA Fisheries designated critical habitat for this DPS between Redwood Creek, California and Russian River, California in 2006. Potentially suitable habitat for this DPS in RNSP occurs in the Redwood Creek basin and includes all stream and estuarine reaches accessible to the species. Accessible reaches are those within the historical range of the DPS that can still be occupied by any life stage of the species. Copper Creek and Redwood Creek are designated critical habitat for NC steelhead.

Birds

Bald eagles—Bald eagles are commonly observed in the Redwood Creek and Mill Creek basins and at the mouth of Redwood Creek, at the mouth of the Klamath River south along the coast to Gold Bluffs Beach, at Freshwater Lagoon, and over coastal areas. Eagle roosting and nesting sites are generally large old trees in open, uneven-aged mature or old-growth forests near lakes, streams, and rivers. Areas within 0.25 mile of major creeks and rivers are considered to contain suitable nesting habitat. Bald eagles have nested successfully in both the northern and southern parts of the park. Bald eagle breeding season extends from January 1 through August 31. Although bald eagles are no longer a federally listed species, they are listed as endangered by the state of California. Monitoring is

continuing as part of the long-term management for bald eagles, which are specifically protected under the Bald and Golden Eagle Protection Act.

Marbled murrelets—Marbled murrelets are sea birds that feed in nearshore ocean waters and nest in coastal old-growth forests along the west coast of North America. More than half of the population of marbled murrelets in California is found in the marine waters off the coast of RNSP. Lower Redwood Creek and Prairie Creek host some of largest numbers of murrelets in forests south of Puget Sound, Washington. The three state parks within the RNSP boundary contain designated critical habitat for marbled murrelets. Only suitable nesting habitat is included in the definition of critical habitat; ocean habitats are not included in the critical habitat designation. The primary constituent elements of critical habitat for murrelets are defined by the USFWS as “individual trees with potential nest platforms and forest lands of at least one half site-potential tree height regardless of contiguity within 0.5 mile of individual trees with potential nesting platforms and that are used or potentially used by marbled murrelets for nesting or roosting.” (USFWS 1996)

RNSP represents the largest block of public land with suitable and near-suitable marbled murrelet nesting habitat in California, and contains about seventy percent of the potentially occupied murrelet nesting habitat in the state. Suitable murrelet nesting habitat consists of mature and old-growth forest with nesting platforms and adequate canopy cover surrounding the nest site. RNSP currently contains about 43,000 acres of suitable murrelet nesting habitat, about 41,000 acres of which is old growth forest and the remainder is isolated old-growth stands or residual old-growth trees that contain suitable nesting characteristics. All suitable habitat is considered to be occupied by murrelets unless surveys show otherwise.

Characteristics associated with murrelet habitat are large trees with lateral branches at least four inches in diameter, which provide nesting platforms, and a mature understory that extends into the canopy of the old-growth forest, which provide protection for potential nest sites from predators. Forest stands containing trees greater than 32 inches dbh may be considered potential suitable nesting habitat. Nesting habitat includes the forest stand in which nest trees are contained. Nest stands are defined as contiguous mature and old-growth forest with no separations greater than 330 feet wide. The nesting season for marbled murrelets in RNSP is considered to extend from March 24 to September 15.

Northern spotted owls—Northern spotted owls are forest-dwelling birds that nest in old-growth forests in RNSP. One atypical nest site is found near oak woodlands in the parks. The nesting season for northern spotted owls in RNSP is considered to run between February 1 and September 15. Closed-canopied forest stands with a semi-open understory, with associated snags and large down logs, provide the primary nesting and foraging habitat for northern spotted owls. Suitable habitat contains numerous large snags, groundcover characterized by large accumulations of logs or other woody debris, and a canopy open enough to allow owls to fly within and beneath it. Second-growth forests older than 40 years and forest stands as small as one acre (or less with remnant old-growth trees) are also considered potentially suitable spotted owl habitat. There are about 55,000 acres of habitat in RNSP suitable for roosting, foraging, and nesting for northern spotted owls. This includes all old-growth and uncut forests and second-growth forests cut more than 40 years ago.

Four known spotted owl activity centers are within the areas potentially affected by fire management activities (Coyote Rock, Maneze, South Fork Little Lost Man Creek, and Bobcat Creek.) A spotted owl pair was first discovered at Coyote Rock in 1993. One fledgling was produced in 1994, 1999, and 2003 while two fledglings were produced in 2000. No productivity was recorded for any of the intervening or subsequent years. A non nesting pair was found in the activity center in 2007; a single male was found in 2008; and a non-nesting pair occupied the site in 2009. This activity center is an anomaly in RNSP because of the reproductive success of the owls occupying it despite the very small area of what has traditionally been considered suitable habitat (e.g. Forsman et al. 1984, Hunter et al. 1995) within the home range of this activity center. A single male was first discovered at Maneze in 1993 and was detected again in 1994 and 1996. The activity center has been vacant since 1997 and is now considered inactive. The South Fork Little Lost Man Creek and Bobcat Creek sites have had regularly occurring barred owl (*Strix varia*) pairs near the spotted owl activity centers. Areas occupied by barred owls are considered to be unsuitable for spotted owl nesting (2004 addendum to Sakai 2003. South Fork Little Lost Man Creek was first discovered in 1993. One fledgling was produced in 1993, 1994 and 1998, respectively. The activity center was unproductive in the intervening years. The activity center was vacant between 1999 and 2001. In 2002 a barred owl pair was discovered in the activity center while a single male spotted owl was found in 2003 and a single female was found in 2005. A barred owl was found in the activity center in 2006. Bobcat Creek was first discovered in 1993. Two fledglings were produced in 1997 and one fledgling was produced in 1999, 2001, and 2004 respectively. Unreproductive spotted owl pairs were in the activity center from 2005-2007. A reproductive barred owl pair was found in the activity center in 2002 while a single male spotted owl and an unproductive barred owl pair was found in 2003.

Mammals

Pacific Fisher—No surveys have been conducted for fishers within specific fire management units. A random-systematic, park wide survey was conducted by Slauson et al. (2003). Fishers were found to be well distributed throughout all suitable habitat areas of RNSP; therefore, all suitable habitat is assumed to be occupied. The total number of fishers, their distribution and their reproductive status within areas that would be affected by fire management activities are currently unknown.

Cultural Resources

Cultural resources in RNSP include archeological sites, historic structures, ethnographic resources, cultural landscapes, and museum objects, as defined in NPS Director's Order 28. Cultural resources can be sites, objects, structures, places, landscapes, or natural elements of places or landscapes.

General Prehistoric and Historic Context—Documented human occupation or use of land under Redwood National Park jurisdiction and vicinity date to as early as 5,000 to 7,000 years ago (Benson 1983, Tushingham et al. 2008). Evidence of prehistoric human activities include village sites, seasonal camps, and trail use sites reflected in the archeological record by artifact concentrations and associated features found in the Bald Hills prairies, along the coast, and in some instances within forested areas in the Redwood Creek basin and other perennial drainages. Historic-period activities on park lands included exploration, cattle and sheep ranching, dairies, farming, logging, mining, establishment of overland transportation routes, and World War II and cold war era military history.

American Indians have lived in the area continuously for thousands of years. They live in local communities, reservations, or rancherias around the parks, and continue to practice traditional lifeways. Lands that are now part of RNSP are within aboriginal Tolowa, Yurok, and Chilula territory. Tolowa territory extended north along the coast from Wilson Creek and included most of the Smith River watershed in the interior. Yurok territory bordered the Tolowa to the south and extended from Damnation Creek in the North to the Little River along the coast, and included the lower 45 miles of the Klamath River watershed. Chilula territory included most of the lower Redwood Creek drainage and included the Bald Hills area (Eidsness 1988).

The Klamath River Reservation was established along the lower portion of the river in 1855 through a presidential executive order. In the late 1860s and 1870s, a number of Americans took up residency on the reservation but were evicted in 1879. In 1891, President Harrison enlarged the nearby Hoopa Valley Indian Reservation to include lands along the Klamath River to one mile on either side of the river, from just upriver of Weitchpec to the Pacific Ocean, thus encompassing the original Klamath River Reservation. In 1892, Congress opened the reservation to homesteading by non-Indians and awarded allotments to Indians living along the river. Because of the homesteading, the majority of lands along the Klamath River within reservation boundaries are owned by non-Indians. The Hoopa-Yurok Settlement Act of 1989 divided the Hoopa Valley Indian Reservation into the Yurok and Hoopa Valley reservations. The Yurok and Hoopa Valley tribes are currently amending the Act to establish jurisdiction for lands and resources, and to provide the legal background for appropriation of funds, management of lands and resources, and development of infrastructure and economic opportunities for the Yurok Tribe.

Following severe flooding along the Klamath River in the winter of 1861-62, the reservation was essentially abandoned. A new reservation site was selected north of Crescent City. Numerous Tolowa were concentrated here, along with members of tribes from the Mad and Eel Rivers south of aboriginal Yurok territory.

The NPS has held regular consultations with the American Indian community since 1978, initially with five American Indian heritage advisory committees representing different geographic areas of the parks and different Indian groups. In the 1990s, consultations shifted from heritage advisory committees to tribal governments. Currently, there are five tribal governments whose members have ties to lands within the parks. These governments include three Tolowa governments (Smith River Rancheria of California, Elk Valley Rancheria of California, and the Tolowa Nation); the Yurok Tribe of the Yurok Reservation, California; Coast Indian Community of Yurok Indians of the Resighini Rancheria, California; Big Lagoon Rancheria of California; and Cher-Ae Heights Indian Community of the Trinidad Rancheria, California; and the Hoopa Valley Tribe of the Hoopa Valley Reservation, California. Only the Tolowa Nation is not a federally recognized tribe.

In March 2009 a general agreement was renewed by the NPS, CDPR, and the Yurok Tribe, establishing and formalizing a government-to-government relationship. In addition, the Yurok Tribe, under the provisions of the Tribal Self-Determination Act of 1994, has assumed state historic preservation office functions for all lands within the reservation boundaries.

The first Euro-Americans in the area that is now RNSP were engaged in exploration, fur-trading, mining, and packing and freighting of supplies for mining camps along the interior rivers. Settlements were established along the coast, attracting farmers and ranchers who settled along the pack trails and coastal bottomlands. Other settlers farmed and raised cattle in the Bald Hills area and provided amenities for teamsters stopping en route to the interior mines. Often the pack trains would stop in Elk Camp Prairie and wait until there were sufficient numbers to make safe passage through Indian territory. Most of these early farms and ranches were abandoned during the period of Indian conflict (Bearss 1969; Eidsness 1988). Later ranches, most notably the Lyon's family ranch, were established in the Bald Hills initially raising cattle, but later switching to sheep. Wool produced in the Bald Hills would become world renowned and ranching continued in the Bald Hills until the area was acquired for inclusion into the park (Bradley and Corbett 2001).

The area of the park known as Requa was also developed during World War II and the cold war. The World War II observation station, which is listed on the National Register of Historic Places, was used to listen for and track possible submarine activity off the Northern California Coast. Patrols along many of the coastal roads were also regularly practiced especially along the Gold Bluffs Beach area. In addition, just after World War II and during the Cold War the area currently known as Requa was developed into the Klamath Air Force Station.

Archeological Resources—Archeological resources “are the remains of past human activity and records documenting the scientific analysis of these remains.” As of September 2009, a total of 112 archeological sites are documented in the national park and an additional 37 in the state parks or nearby vicinity. These include prehistoric village sites, seasonal camps, procurement sites, and trail use sites. Historic period archeological sites include structures and associated features related to ranching and farming, and historic-period trash scatters related to settlement, logging, and mining, as well as various ranching landscape features such as fence lines and stock ponds.

The Bald Hills Archeological District was first listed on the NRHP in 1982 and then expanded in 1985. The District consists of twenty-six (26) sites including villages, seasonal camps, trail use routes, concentrations, flake scatters, and a ceremonial place all located in the Bald Hills portion of the park. The Noledin Village Site was determined eligible through consultation with the California SHPO in 1991, and three other archeological sites located in Coastal Del Norte County are also listed on the National Register of Historic Places.

Prairie Creek Redwoods State Park contains additional prehistoric resources including a Yurok village site, two flake scatters, and one chert quarry. Another site is a trash dump with both historic and prehistoric components. Prairie Creek Redwoods State Park also includes the Old Cabin and Store Site at the south end of Boyes Prairie and the site of a civilian conservation corps camp in Elk Prairie. Although none of these sites have been evaluated for listing on the NRHP, each is considered to be potentially eligible for listing until determined otherwise.

There are also many sites in Jedediah Smith Redwoods and Del Norte Coast Redwoods State Parks consisting of historic mining ditches, historic roads, prehistoric villages, and campsites.

Historic Structures—Structures “are material assemblies that extend the limits of human capacity,” and comprise such diverse objects as buildings, bridges, vehicles, monuments, vessels, fences, and canals. Thirty structures in the national park are included on the List of Classified Structures (LCS). Twenty of these LCS structures are contributing elements to the Lyons’ Ranches Rural Historic Landscape District that was determined eligible by NPS and SHPO consensus in September 2004.

Listed on the NRHP are the World War II Radar Station B-71, Redwood Highway, and Prairie Creek Fish Hatchery.

In Prairie Creek Redwoods State Park, the Elk Prairie Visitor Center and associated structures are all historically significant as examples of Civilian Conservation Corps (CCC) construction carried on in state parks during the 1930s. The site consists of the headquarters building, a comfort station at the rear of the headquarters building, a footbridge to the northeast, and a concrete picnic stove along the south side of Prairie Creek. The headquarters is also significant as an example of the rustic, nonintrusive architectural style pioneered by the NPS between 1916 and 1942.

The Boyes House and associated structures are in the northeastern section of Elk Prairie (Boyes Prairie). The site consists of an early 20th century Bungalow Style residence, a detached garage built around the same time as the house, four modern park maintenance buildings, three one-story cottages erected around 1947 to 1948, and a small orchard that surrounds the south and west sides of the Boyes House.

The CCC also worked in Jed Smith Campground in Jedediah Smith Redwoods State Park, although little of any original CCC work is found there today (Maniery and Millett 2008).

Ethnographic Resources and Traditional Activities on Park and Aboriginal Lands—

Ethnographic resources “are basic expressions of human culture and the basis for continuity of cultural systems” and encompass both the tangible (native languages, subsistence activities) and intangible (oral traditions, religious beliefs). These can include archeological sites, old ethnographic village sites, travel routes, fishing and hunting camps, locations of ceremonial significance, and areas traditionally used to gather resources. The Bald Hills and Klamath River areas of the park are both contain all of the various forms of ethnographic resources.

Village sites, many now recorded as archeological sites are found throughout these areas. Many prominent natural features found in these areas are of special ceremonial significance to the Yurok, Tolowa, and Chilula who are ancestral to these areas and include prayer seats or areas used for the world renewal or brush dance ceremonies. Traditionally important plant resources include but are not limited to hazel shoots and nuts, salmonberry, tanoak, black oak, elderberry, ocean spray, gooseberry, huckleberry, honey suckle plant, “wild parsley,” bear grass, horse tails, maple, madrone, licorice fern, and manzanita (Gates et al. 2000, 2002).

Principal settlements for all three groups (Tolowa, Yurok, Chilula) were typically situated along the coast and rivers or creeks. Villages were often located in clusters with the population centered around a large village with smaller villages or hamlets in the vicinity. These locations were occupied by the bulk of the population throughout the year with temporary campsites near specific resources used

seasonally by small groups to exploit seasonally available resources. The range of resources utilized and subsistence technology were diverse. Shellfish collecting, fishing, sea and land mammal hunting, fowling, and gathering edible and medicinal plants, especially acorns were and continue to be important subsistence activities. These resources were gathered while seasonally abundant and were then stored to provide nourishment during lean times of the year. Shelter consisted of houses and sweathouses made from split redwood or cedar planks. Basketry and wood-working were important and wealth was recognized in the form of non-subsistence goods such as very large chert and obsidian blades, white deerskins, red woodpecker scalps, and dentalia shells (Gould 1978; Pilling 1978; Wallace 1978).

Fire use consisted of intentional burning of open prairies, burning of understory around tanoak and white oak stands, and other areas. Hazel sprouts and bear grass that require fire for traditional maintenance were gathered for use in basketry, and various seeds and tubers were collected for food. Burning not only made resource collection easier, but also eliminated competition stimulating plant growth and improved forage for elk and deer. Oak stands were burned to maintain the open stands and improve acorn harvests. Prairies were burned to maintain the open grassland and to improve browsing areas for large game animals that were taken for food (Lewis 1993; Anderson 1993; Gates et al. 2000, 2002). Some of the prairies may be eligible for listing as traditional cultural properties that were maintained through traditional practices such as burning and thinning.

Among the local Yurok, Tolowa, and Hupa, many aspects of the traditional lifeways continue on both RNSP and adjacent lands. The parks contain sites that are integral to the practice of traditional American Indian spirituality, subsistence, and lifeways. Some fishing areas, gathering areas, and ceremonial sites now within RNSP have been used by the ancestral American Indian community for thousands of years. Certain dances are held, and others are being revived that entail the maintenance of dance sites with their traditional structures and the fabrication of dance regalia. Many of the arts, such as canoe making and basket weaving, also are practiced, which require certain natural resources, many of which are found within the parks. These arts are sources of economic as well as spiritual sustenance.

Cultural Landscapes—Cultural landscapes are “settings we have created in the natural world.” They are intertwined patterns of natural and constructed features that represent human manipulation and adaptation of the land.

Currently there are six cultural landscapes in the national park eligible for or potentially eligible for listing in the NRHP including the Bald Hills Ethnographic District, Klamath River Ethnographic District, Lyons’ Ranches Rural Historic Landscape District, Old Redwood Highway, Prairie Creek Fish Hatchery, and Radar Station B–71. These are also listed on the NPS Cultural Landscape Inventory. Currently the Old Redwood Highway, Prairie Creek Fish Hatchery, and Radar Station B–71 are listed on the NRHP as structures, and the Lyons’ Ranches Historic District has been determined eligible by NPS and SHPO consensus. Contributing features of the Historic District include prairies, oak woodlands, historic barns, cabins, outbuildings, roads, orchards, and water related features.

In Prairie Creek Redwoods State Park, the visitor center and associated structures (see earlier description under Historic Resources) are part of a cultural landscape that is potentially eligible for listing on the NRHP.

National Register of Historic Places—Currently there are four prehistoric archeological sites, two historic complexes, one archeological district, and one historic district, listed on or determined eligible for the NRHP by the keeper of the register.

The NPS is continually making efforts to identify if other cultural resources are eligible for listing on the NRHP and there are currently three other eligibility determinations in process.

Visitor Experience and Visual Quality

Total visitation to the national park in 2008 was reported as 401,830 recreational visits.

The primary scenic resources in RNSP are the coastal redwood forest, the vistas of the Pacific Ocean and the rocky shoreline, and the oak woodlands and open prairies of the Bald Hills.

Coast redwoods are the tallest living things; several of the tallest known trees in the world are in the parks. The coast redwood grows as a natural forest only in a narrow strip along the northern California and southernmost Oregon coast. Of the two million acres of old growth redwood that existed in 1850, less than 5% are protected in national, state, and local parks.

Timber harvest and road building have altered the scenic qualities and vistas throughout the parks. Clearcut blocks are visible as distinct and sometimes abrupt vegetation changes on the forested hillslopes. The linear imprints of logging roads, including roads that have been removed under the watershed restoration program, are frequently encountered in both logged and unlogged forests but the roads are becoming less visible as the forest canopy regrows. There are open vistas along Highway 101, the Bald Hills Road, and coastal bluffs and beaches. Visitor use in areas with active watershed and forest restoration operations is discouraged because of safety considerations created by intensive heavy equipment work.

Other visitor activities include wildlife viewing, primarily for Roosevelt elk, guided walks environmental education for local schoolchildren at the Wolf Creek and Howland Hills Outdoor Schools, and evening campfire programs at the state park campgrounds.

ENVIRONMENTAL CONSEQUENCES

This section examines the effects of the alternatives for fire management on the natural and cultural resources in the park, park operations other than fire management operations that are covered in detail in the Fire Management Plan, visitors and the visitor experience, and adjacent communities. These effects are discussed in relation to other past, present, and reasonably foreseeable actions related to the alternatives and to the resources in the park and the region, as well as any potential for impairment of national park resources and values.

Methodology

Impacts on a particular resource are predicted based on impacts observed and measured from previous fire and vegetation management projects, relevant scientific research and publications, and best professional judgment of park specialists, and fire management and forestry professionals familiar with the resources and fire management practices in the region. Impact analyses based on best professional judgment of park resource managers are derived from their analyses of effects of fire management actions within and outside of RNSP, including past monitoring; discussions with knowledgeable local and regional fire management specialists, botanists, forest ecologists, geologists, biologists, and cultural resource specialists; and reports and studies prepared by academic, forest industry, and government agency personnel on the effects of fire management in the region. Potential effects of fires in old growth and second growth redwood forests are derived from analyses of the 2003 Canoe Fire in Humboldt Redwoods State Park, the Xowannutuk Fire in Redwood National Park in 2003, and prescribed fires in a second growth forest stand in Redwood National Park in 2007.

Impact Definitions for Natural Resources

Impacts are analyzed according to the type of impact (beneficial or adverse), the timing and duration of impact (short-term, long-term, one-time, occasional, or repeated), and the severity or intensity of impact (no effect, negligible, minor, moderate, or major). These factors are also considered in the context of the geographic location of the park and the region.

Context—The context of an action includes consideration of the effects on resources in the project area, and on similar resources within RNSP, the local area surrounding the parks, and the region.

The geographic context of an impact includes consideration of the project area, the parks as a whole, and local and regional conditions.

Timing and Duration—The timing of an impact is also part of its context. For example, clearing brush and tree limbs in January to create a shaded fuel break would not affect nesting birds but clearing the same area in June would disturb nests in the brush or trees.

The duration of an impact considers whether an effect would happen immediately, the length of time over which an impact occurs, and how long it would be noticeable. Duration is defined as short-term or long-term. In general, long-term effects would be those that are repeated over at least several years or that would not be immediately noticeable.

Duration also depends on the resource affected. Short-term effects on annual vegetation would generally be on the order of a year or less, because a year includes one complete growing season. For resources such as soils, plant communities, long-lived plants such as redwood trees, or geological processes such as large flood events, long-term refers to effects on the order of decades to centuries.

Type—The type of impact describes whether an action would benefit or harm a resource. A beneficial effect improves the condition of a resource, protects it from damage or loss, or favors the persistence of a resource. A harmful or adverse effect is one that worsens the condition of a resource, damages or degrades a resource, leads to the loss of the resource, alters it irretrievably in an undesirable way, or changes its essential character so that the resource no longer possesses integrity or its defining characteristic. Adverse effects are unfavorable to the conservation and preservation of the resource.

Intensity—Intensity, degree, or severity of an impact refers to how much of an effect an action has on a resource and is described as negligible, minor, moderate, or major. Major effects are considered significant. Determining intensity relies on understanding the range of natural variation of a resource. If an action has no effect on a resource, or if the effect is barely noticeable or measurable, the effect is considered negligible. Negligible effects are those that are unnoticeable, undetectable, or result in no change to a resource, or that affect so few individuals that the effect cannot be distinguished from the natural variability for a resource. Significant effects are always noticeable and result in a permanent change to a resource over a large area.

Levels of change between negligible and significant are described as minor or moderate. Minor changes to a resource are detectable but there is no long-term or permanent alteration of the resource and the changes are within the range of natural variability. Minor effects are generally noticeable but result in only a slight change to a resource or occur in a small area, and do not change resource function.

Moderate effects are always noticeable and result in some change to the resource or its function, and occur in several areas. If an action changes the resource completely or a change is irreversible, the effect is considered significant or major. Actions are more likely to result in a gradient of change rather than a distinct level of change, so that some effects may be judged “minor to moderate” to indicate that portions of a resource in different locations might be affected slightly differently by the same action. For natural resources that are distributed discontinuously across a landscape or where individual elements of a resource are not exactly equivalent to other individuals or pieces of the same resource, a range of effects from a single action is likely.

The intensity of an impact also includes consideration of how widespread or local the area of impact would be, the amount of a resource that might be affected, or the number of times an effect would occur. If an action affects all of a resource within the parks, that impact would be considered major or significant. For example, conducting a prescribed burn in one grassland unit in the Bald Hills would have moderate effects on the wildlife occupying that one unit but negligible effects on wildlife in adjacent unburned units. Prescribed burns of all grassland units in the Bald Hills within a few

weeks would have greater effects on wildlife because there would be no unburned area to provide refuge for displaced animals.

Intensity of effects on wildlife and plants is determined based on the number of individuals affected in relation to the total population in the project area, the park, the region, and the range of the species. If only a few individuals are affected, the impact would be considered negligible. If an action affects more than a few individuals but the effects are within the natural level of variability for a population or a resource, the effect is considered minor. If an action affects many or all individuals and causes changes to populations that are greater than the natural level of variability, the effect is considered moderate.

For sensitive wildlife and plants, there are two sets of definitions of intensity. The definitions used in this EA are based on the NEPA regulations (40 CFR 1500, et seq.) and the NPS guidelines for implementing NEPA. The USFWS uses a second set of definitions to accompany its determinations of effect based on its regulations for implementing the Endangered Species Act of 1973, as amended (19 U.S.C. 1536 (c); 50 CFR 402). Negligible effects on listed species for the purpose of this EA are defined as those that are unnoticeable or that the USFWS has determined to have “no effect.” The USFWS has defined a “no effect” determination as the “appropriate conclusion when the action agency determines its proposed action will not affect listed species or critical habitat.” USFWS defines impacts that result in a determination of “may affect but not likely to adversely affect” as “discountable or insignificant”; these effects are defined in this EA as minor. Adverse effects occur if impacts are not discountable, insignificant or beneficial. Impacts that are determined to be adverse but can be lessened or minimized, even though incidental take may still result, are considered moderate. An effect that is determined by the USFWS to result in jeopardy to a listed species is defined as major or significant.

Impact Definitions for Cultural Resources

Federal land managing agencies are required to consider the effects of their proposed actions on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., Historic Properties), and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment as per the National Historic Preservation Act, as amended and its implementing regulations found at 36 CFR Part 800. Agencies are required to consult with Federal, state, local, and tribal governments/organizations, identify historic properties, assess adverse effects to historic properties, and negate, minimize, or mitigate adverse effects to historic properties while engaged in any federal or federally assisted undertaking (36 CFR Part 800).

Requirements for proper management of museum objects are defined in 36 CFR Part 79.

Adverse effects to historic properties are those that may “alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register of Historic Places in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling or association” (36 CFR 800.5).

Cultural resources, including prehistoric and historic archeological sites, prehistoric and historic buildings, structures, districts and objects are subject to impacts during fire events.

Direct impacts to cultural resources include the effects of fire itself on cultural materials and fire management operations such as fire control line construction or crew and equipment staging. Indirect impacts occur when fire and/or associated fire management operations result in changes to the local environment such as increased erosion or increased exposure of artifacts to looting resulting in potential effects to cultural resources. Cumulative impacts consist of direct and indirect impacts that might have minor effects individually but have greater effects on the historic property when combined or extended over a period of time.

Non-Impairment of Park Resources and Values

The NPS is required by law to manage park resources and values in such a way as to leave them unimpaired, unless a particular law directly and specifically provides otherwise. NPS management policies require that environmental documents disclose whether an action has the potential to impair park resources or values. Impairment is defined in NPS Management Policies 1.4.5 (NPS 2006a) as an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts. An impact is less likely to constitute impairment if it is an unavoidable result, which cannot reasonably be mitigated, of an action necessary to preserve or restore the integrity of park resources and values. An impact would be more likely to constitute impairment if it affects a resource or value whose conservation is necessary to fulfill specific purposes identified in the park's establishing legislation, or which are key to the natural or cultural integrity of the park or the opportunities to enjoy the park, or which are identified in the park's general management plan as being of significance.

Analyses and findings for non-impairment of resources or values follow the analyses of effects on natural and cultural resources.

EFFECTS ON CLIMATE AND AIR QUALITY

Fire management actions do not directly affect climate but climate affects fire management by timing and amount of annual and seasonal precipitation. Large wildfires can have short-term effects on local weather.

Adverse effects on air quality under Alternative 1(2010 FMP proposed action) and Alternative 2 (2005 FMP, no action) are essentially equivalent and result from smoke from prescribed fires (broadcast and pile burning) and from emissions from vehicles and equipment such as chain saws. Adverse effects on air quality from smoke from wildfires and emissions would result under any alternative, including the proposed action (Alternative 1, 2010 FMP), no action (Alternative 2 2005 FMP); or Alternative 3 (suppression only).

Emissions are produced by machines used in site preparation and fuel reduction activities including chain saws, chippers, and vehicles used to fight fire and to transport people and equipment. Emissions are subject to state air quality regulations. Adverse effects on air quality from emissions from vehicles and equipment are localized, temporary and repeated over the life of the plan, and negligible.

The effects on air quality under Alternative 1 (2010 FMP proposed action) would be greater than the effects under Alternative 2 (2005 FMP no action) because prescribed fire is proposed on 6800 acres and pile burning from 468 acres of shaded fuel breaks under Alternative 1 compared to 4600 acres for prescribed burns and 416 acres of shaded fuel breaks under Alternative 2 (2005 FMP). Prescribed burns under Alternative 1 or Alternative 2 would take place over 5 years. Although broadcast burns are scheduled, they are only implemented if prescriptions can be met, so the effects on air quality in any given year under Alternative 1 cannot be compared directly with potential effects under Alternative 2.

Both wildfire and prescribed fires reduce air quality by creating smoke. The primary adverse effects from smoke in RNSP and the surrounding area are decreased visibility and the production of air pollutants. Smoke is a complex mixture of carbon, tars, liquids, and gases. The major pollutants in smoke are particulates (PM10 and PM2.5), volatile organic compounds, and carbon monoxide and carbon dioxide. Regulated pollutants for which standards have been established by the Environmental Protection Agency (EPA) include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter smaller than 10 microns in diameter (PM10) and smaller than 2.5 microns in diameter (PM2.5).

The North Coast Unified Air Quality Management District (NCUAQMD) monitors air quality and meteorological conditions and would permit prescribed fire operations only when conditions would not result in significant adverse effects on health and safety from smoke. The district coordinates requests for clearances for prescribed fires planned by all federal, state and local agencies, Tribes, timber companies, and private organizations to reduce the overall amount of smoke generated in the region. A Smoke Management Plan would be filed with the NCUAQMD as part of the Prescribed Fire Plan for each unit prior to ignition.

In general, air quality in RNSP and the surrounding area meets or exceeds standards set by the EPA because the prevailing winds come from the northwest across the Pacific Ocean where there are no significant emission sources. Air quality returns to very good to excellent quality after prescribed fires are extinguished. The amount of time for regional air quality to return to pre-disturbance condition depends on the prevailing winds and the movement of air masses but air stagnation or long-term inversions that cause poor air quality mostly occur during the late fall and early winter.

Reduced visibility from smoke can affect safety if the smoke becomes dense enough to impair visibility on roads and highways. The public roads in RNSP where smoke could impair driving are the Bald Hills Road and US Highways 101 and 199. If smoke obscures driving visibility, fire and public safety personnel would implement traffic controls. This impact would be adverse, short-term, localized, and minor to moderate. The intensity of the effect depends on the size, duration, and

intensity of the fire, and the wind direction. If the road has to be closed because dense smoke reduces visibility so that driving is unsafe, the impact would be considered significant. Significant adverse effects on visibility on highways would be unlikely from prescribed fire under either Alternative 1 (2010 FMP proposed action) and Alternative 2 (2005 FMP, no action). Adverse effects on visibility from smoke from wildfires under any of the alternatives would range from minor to significant, depending on the location, size, and duration of the wildfire.

Cumulative Effects on Air Quality

The NCUAQMD coordinates planned ignitions in Humboldt, Del Norte, and Trinity Counties to minimize adverse smoke effects on sensitive receptors (local communities and highways). The cumulative adverse impacts of smoke on park resources, visitors, and adjacent communities from park-ignited prescribed fires would be short-term and localized.

Smoke from wildfires is an unavoidable adverse effect that cannot be mitigated directly. Although smoke is temporary until a fire is extinguished, the short-term effects on human health would be serious for those people who have respiratory problems or extreme sensitivity of some chemicals in smoke. When air quality worsens to the unhealthy or hazardous level, people are advised to remain indoors, close doors and windows, and run an air conditioner. If a residence does not have an air conditioner, which is common in the communities around RNSP because of the moderate climate, and if it would be too hot indoors with closed windows, the EPA advises against closing windows. The ambient temperatures in local communities that would be affected by smoke from fires in RNSP are generally cooler than inland areas where it would be dangerous to remain indoors with windows closed. The cumulative impact of smoke from wildfires has the potential to have extreme adverse effects on air quality, including visibility, human health, and safety, in the area if large fires are burning in the park or the surrounding area.

Conclusions (Effects on Air Quality)

The effects of air quality on park resources, visitors, and adjacent communities from park-ignited prescribed fires under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) are from smoke and would be adverse, short-term, localized, and generally negligible. There could be moderate localized adverse effects immediately adjacent to prescribed burns.

EFFECTS ON GEOLOGY, TOPOGRAPHY, AND SOILS

There would be negligible effects on geological resources and topography from planned fire management actions under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 fire management program). Construction of fire lines and use, maintenance, and minor upgrades of existing roads for access would have no new direct effects on geological resources and topography.

Effects on soils from planned fire management activities under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 fire management program) would result primarily from construction of fire lines for prescribed fires and around historic structures, from pile burning, or from maintenance of roads used for access. Under Alternative 3 (suppression only), effects on soils would depend on the size of the fire. The total acres of soils that might be affected

from suppression of wildfires cannot be estimated. Most soils where planned fire management actions would occur are in areas where soils have been previously disturbed by logging, ranching, road construction, or previous fire management actions. The effects of soils from suppression actions under any of the alternatives would be similar to the effects discussed below.

Under Alternative 1 (2010 FMP proposed actions), up to 9 acres of soils would be affected by construction of fire lines around 36 prescribed fire units over the 5-year life of the plan. Not all of the prescribed fire units require soil disturbance for fire lines. Units with a road for a boundary or units that rely on “wet lines” such as changes in vegetation type from drier fuels like grass to damper fuels like shaded areas under trees) do not require soil disturbance for fire line construction.

Under Alternative 2 (2005 FMP = no action), up to 6.1 acres of soils would be affected by construction of fire lines around 28 prescribed burn units.

Soils would be affected by pile burning associated with shaded fuel breaks on 468 acres under Alternative 1 (2010 FMP proposed action) or on about 416 acres of soils under Alternative 2 (2005 FMP, no action) would have short-term minor adverse effects on soils and negligible long-term effects.

There are two types of impacts on soils from fire activities—impacts from fire itself and impacts from preparation and suppression activities. Impacts from fires are generally indirect and result from loss of vegetation cover that leaves soils exposed and susceptible to erosion from wind, rain, or disturbance from people and equipment. Extremely hot fires can directly affect soils by consuming organic matter in the soils (as opposed to a layer of organic litter on top of the soil but not yet incorporated into the soil profile) and changing the soil chemistry so that soils become hydrophobic and unable to absorb water. Catastrophic fires have the potential for significant direct adverse effects from soil sterilization and significant adverse indirect effects from removal of vegetation on steep slopes with highly erodible soils. Prescribed fires are planned to minimize soil erosion by conducting burns at lower temperatures that burn upper layers of vegetation and organic layers but not soil organic matter and do not affect soil chemistry. In the long-term, the effect on soils would be beneficial and minor from the reduced chance of catastrophic fire that results from regular prescribed burning.

Site preparation and implementation of prescribed fires have the potential to increase soil erosion because vegetation and organic litter are removed for fire lines or consumed by the fire. Erosion would be greatest along stretches of fire line that run down rather than along the contour of the slope. Soil compaction and disturbance would occur both with hand line and with mopping up after the fire. Waterbars and check dams would be used to reduce runoff and resulting soil erosion. Hand lines for prescribed fires are located based on the ability of soils to withstand disturbance so the soils can support vegetation after the fire. Using roads for fire breaks reduces new impacts to soils. Camp and staging areas would be located in previously disturbed areas such as logging landings. Compacted soils on hand lines and at camps located in pristine areas would be broken up with hand tools to allow water penetration and revegetation. Topsoil that was scraped off to construct hand lines would be pushed back onto the hand line.

Effects on soils from construction of fire lines would be adverse and short-term. Fire lines around prescribed fires would affect smaller areas of soils than fire lines required for wildfire suppression because prescribed burns are conducted under a set of established conditions with adequate time for preparation. Where fire lines are constructed by hand (hand lines), topsoil is scraped off down to mineral soil to a width of no more than four feet and piled on the edge of the fire line. Fire lines would be rehabilitated after the prescribed burn by replacing the topsoil. These effects on soils would be localized, repeated annually around historic structures, and negligible.

Pile burning creates variable conditions in small patches. Some patches would burn hotter and would result in small areas of sterile soils. Biological functions would return quickly in these small patches because adjacent areas would serve as sources of soil and seeds. Effects on soils from pile burning would be localized, repeated when shaded fuel breaks are maintained, and negligible.

Suppression activities on large fires sometimes use water or chemical drops from aircraft to suppress or retard fires. Impacts to soils from water or chemical drops are physical impacts that are localized, short-term and negligible. Chemical retardants contain fertilizer-type compounds, including ammonia and nitrates, which can change chemistry of those soils that are otherwise low in these nutrients. The half-lives of these chemicals in soils are short. Impacts from chemical retardants and suppressants on soils are localized, short-term, and negligible to minor.

Most fire management activities that have the potential to cause soil erosion are similar to other on-going management activities such as road and trail maintenance. Almost all planned fire management activities occurs during the dry season when it is possible to use dirt roads that are impassable during wet weather because of soft surfaces or standing water. Best management practices would be used to avoid or minimize soil erosion that might result in sediment delivery to streams. The action most likely to create a potential for soil erosion is replacement of culverts on roads to be used for fire access. Culvert replacement is a routine maintenance task in the parks because of the many miles of former logging roads that are actively failing. A suite of best management practices has been developed for use in the road maintenance and watershed restoration programs in the parks, where old logging roads are maintained, removed, or treated to reduce erosion and subsequent sediment delivery into streams. Best management practices typically implemented during road maintenance include use of silt screens, avoiding work on roads when soils are saturated, use of weed free straw on any exposed soils until revegetation is complete, and permanent stabilization of any structures built within the inner gorge of streams to prevent bank erosion and sedimentation of the stream.

Cumulative Effects on Soils

Under the suppression only alternative (Alternative 3), there is a greater potential over the long-term for adverse effects on geological resources, soils, and topography from heavy equipment used to construct large fire lines or to reopen abandoned logging roads.

Effects on soils in the event of wildfires would vary depending on the size, location, and intensity of the wildfire and the level of suppression required. Intense wildfires have the potential for significant adverse effects on soils from destruction of the organic matter (soil sterilization).

Timber harvest, associated road construction, and subsequent soil erosion and slope failures in what is now the park have significantly altered topography and soils in the park. The additional effect from soil erosion associated with proposed fire management actions would be undetectable.

Conclusions (Effects on Geological Resources, Topography, and Soils)

There would be no new adverse effects on geological resources or topography under any of the alternatives, including the proposed action or no action.

The effects on soils from preparation for and implementation of prescribed fire under either the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) in the short-term would be adverse, localized, and negligible to minor. In the long-term, the effects of prescribed fires on soils would be beneficial due to the reduction of threat of a catastrophic fire that would sterilize soils by destroying the organic material and increase the potential for erosion. The long-term direct effects of prescribed fires on soils within a prescribed fire unit in the absence of catastrophic fire would be negligible.

The proposed fire management actions throughout the parks under either the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) are intended to reduce the long-term potential for wildfire, particularly catastrophic wildfire, and to prepare for more effective suppression in a short a time as possible. The long-term potential for wildfire would increase under Alternative 3 (suppression only) without fuel reductions and prescribed fires. Catastrophic wildfire would create large severely burned areas in which soils would be subject to severe erosion in the rainy season immediately following the season.

EFFECTS ON WATER RESOURCES

Water Quantity—There are no direct effects ground water supplies from planned actions under any of the alternatives, including Alternative 3 (suppression only).

Streams available for water drafting have been identified as part of preparation for suppression. Any drafting from anadromous fish bearing streams including Redwood Creek, the Klamath River, or the Smith River requires a fish screen on the drafting hose to protect sensitive fish species. Dipping from Redwood Creek using helicopters is unlikely because there are no safe places for the aircraft to approach the stream and because the creek is too shallow during the season when wildfires are likely to occur. In a wildfire emergency, it is possible that Freshwater Lagoon or Lagoon Creek would be used for dipping if a wildfire is close and aircraft can safely access these sites without having to fly across US Highway 101. Water from Freshwater Lagoon would only be allowed in areas where the water cannot reach free-flowing park streams in order to avoid spread of invasive exotic plants and mollusks known to be present in Freshwater Lagoon. The effects on water quantity (surface water) from water drafting and dipping for wildfire suppression under all alternatives are negligible.

Water Quality—Impacts on water resources from fire management actions under either the proposed action (Alternative 1, 2010 FMP), the no action alternative (Alternative 2, 2005 FMP), or Alternative 3 (suppression only) are primarily indirect effects on water quality in park streams. Suspended

sediment and temperature are the two elements of water quality most likely to be affected by planned fire management actions.

Effects on water quality under the proposed action (Alternative 1, 2010 FMP) are similar to those under the no action alternative (Alternative 2, 2005 FMP). Effects on water quality under Alternative 3 (suppression only) have the potential to be more severe depending on the intensity of the fire and the location of the fire in relation to perennial streams or riparian areas.

Effects on water quality from preparation and suppression actions under either the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) are related to maintenance of roads, construction of fire lines with hand tools or heavy equipment, installation of water tanks, installation of fire camps, trampling of soils by personnel and equipment at fire lines and camps, and use of aerial water drops or chemical suppressants or retardants. These effects are generally indirect effects on water quality from runoff from erosion of soils disturbed by these activities.

Use of chemical suppressants can have direct effects if the chemicals enter surface water. Aircraft delivering chemical drops attempt to avoid hitting water bodies. All structures (historic or otherwise) would be protected using standard methods including construction of fire lines, fuel reduction and pretreatment with water and/or foam. No foam would be applied within 300 feet of any intermittent or perennial stream. Chemical suppressants and retardants would have moderate to significant adverse effects on water quality depending on the water body, but the effect would be short-term and would persist until the rainy season when high flows would dilute any remaining chemicals.

Catastrophic fires and associated suppression actions have the potential for significant adverse effects on water resources related to erosion of burned areas in the first rainy season following the fire. Depending on the location of a catastrophic fire, the adverse effects on water quality from erosion of bare soil would range from moderate to severe. Catastrophic wildfire has the potential for significant adverse effects on water quality in park streams both from direct effects of burned materials entering streams and over a longer term, from erosion of bare soils and subsequent sedimentation of streams. Because of the existing poor water quality of Redwood Creek and some associated tributaries from sedimentation related to logging and associated road construction prior to park establishment, it would be difficult to distinguish long-term adverse effects on water quality in Redwood Creek from a large wildfire and suppression actions from adverse effects from previous land use.

Preparation for Suppression—Under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP), filling and using five 2500-gallon water tanks and clearing vegetation around four existing ponds would not have any effect on water quality in park streams. Installing two additional rain-filled tanks under the proposed action would not have any effects on water resources in the park.

Under the no action alternative (Alternative 2, 2005 FMP) and Alternative 3 (suppression), the five tanks located along the West Side Access Road; the intersection of Holter Ridge and Geneva Roads; Tall Trees access road; the A-9 Deck; and Ranch Road/Mid Basin Road in Coyote Creek watershed

would be used, but no additional tanks would be installed. Under Alternative 3 (suppression), two ponds that have been prepared for access by fire equipment would be used but two other existing ponds would not be prepared until a suppression action is needed.

There would be no effects on water resources from preparation, use, or maintenance of the ponds. All tanks would be fed with rainwater collected by guzzler-like attachments. The ponds are fed by small springs and are all located on ridges on the upper reaches of watersheds well upslope of perennial sections of streams. Ponds would most likely be used during the dry season when there is no direct hydrologic connection to perennial streams.

Prescribed Fires—Under the proposed action (Alternative 1, 2010 FMP), prescribed fire would be used to treat approximately 6,800 acres. Under no action (Alternative 2, 2005 FMP), approximately 4,600 acres would be treated with prescribed fire.

Table 2 shows the number of intermittent and perennial streams within a certain distance of prescribed fire units. All prescribed fires are scheduled for late summer or early fall when flows are low. Some of the intermittent streams could be dry by late summer, depending on the previous rainy season. No prescribed fire units contain a perennial stream within the unit boundaries.

Under the proposed action (Alternative 1, 2010 FMP), the Wildcat prescribed fire unit is within 150 feet of Copper Creek, a perennial stream. Suspended sediment concentration, pH, organic matter content, fine sediment in pools, and particle size distribution would be monitored at the mouth of Copper Creek above its confluence with Redwood Creek before and after prescribed burns.

There would be no effects on water quality from construction of fire lines under either the proposed action (Alternative 1, 2010 FMP) or the no action (Alternative 2, 2005 FMP) alternatives. Existing canopy cover along all riparian areas within 300 feet of any intermittent or perennial stream would be maintained when constructing fire lines. Any fire lines that cross riparian areas would have water bars installed within 300 feet of any intermittent or perennial stream. Fire lines would be rehabilitated after prescribed burns by replacing the topsoil to prevent erosion of sediment that would run off into streams.

Fuels Management—Under the proposed action (Alternative 1, 2010 FMP), five fuel breaks that would be created or maintained are located along ridge tops at least 300 feet from the nearest perennial stream. Four of the five fuel breaks are in the same locations under both the proposed action and the no action (2005 FMP) alternative.

Pile burning associated with the fuel breaks would have negligible effects on water quality because piles would be located in flat areas away from streams or high in the watersheds. No piles would be burned within 300 feet of any intermittent or perennial stream.

Historic Structure Protection—There would be no effects on water quality from construction of fire lines around historic structures under either the proposed action (Alternative 1, 2010 FMP) or the no

action (Alternative 2, 2005 FMP) alternatives. All historic structures are at least 300 feet from any intermittent or perennial stream.

Cumulative Effects on Water Resources

Other park management activities, including watershed restoration and maintenance of roads, particularly old logging roads, and activities conducted outside the parks, including timber harvest, have the potential to reduce water quality in park streams.

Water quality in Redwood Creek has been significantly affected by logging and road construction prior to park establishment and expansion, and by continued erosion of old roads. These adverse effects are being lessened as damaged watersheds recover, logging upstream of the parks is conducted under current regulations designed to protect water quality, and watershed restoration projects are undertaken.

Effects on water quality from road maintenance associated with fire management actions would recur on an annual basis and would be localized in streams where water quality has already been adversely affected from timber harvest and road construction. The cumulative effect on water quality from planned fire management actions over the 5-year life of the plan under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) is adverse but negligible.

Conclusions (Effects on Water Resources)

Through changes in soil and vegetation cover, fire influences the volume of water and the rate at which water flows in watersheds. In RNSP, some slopes are steep or extremely unstable and some soils are highly erodible because of the underlying geology and parent material. If highly erodible soils are located on steep slopes or in geologically unstable areas, fire can have severe consequences on a watershed if vegetation cover is removed and heavy rains fall on bare slopes. The effect of catastrophic wildfires in some places in the parks would be significantly adverse on watershed structure and function over the long-term.

There would be no direct effects on water resources, especially water quality, under either the proposed action (Alternative 1, 2010 FMP) or the no action (Alternative 2, 2005 FMP) alternatives. Prescribed fire units are typically in headwaters of streams and would have negligible effects on water quality from soil erosion after prescribed fires or from hand line construction. Preparation and implementation of prescribed fire in the Wildcat prescribed fire unit under the proposed action (Alternative 1, 2010 FMP) would be conducted using site-specific best management practices and a water quality monitoring program for Copper Creek. Planned fire management actions would have negligible, indirect, localized, short-term, adverse effects on water quality.

EFFECTS ON FLOODPLAINS AND WETLANDS

The Smith River and its major tributary Mill Creek, Redwood Creek and its major tributary Prairie Creek, and the Klamath River are the only park streams large enough to have well-developed floodplains. There would be negligible effects on the Klamath River floodplain within the park from wildfires because places where wildfires might occur in the parks are either high in tributaries and too far from the river to have an effect or because the fire would occur so close to the mouth of the river

that the effects would be negligible compared to the effects of the Pacific Ocean and indistinguishable from effects of upstream activities. There would be long-term severe adverse effects on floodplains of the Smith River, Mill Creek, Redwood Creek or Prairie Creek from catastrophic wildfires if heavy rains fall on severely burned watersheds with steep slopes and unstable soils in lower reaches of the watersheds where floodplains are present.

There are no planned actions that would affect floodplains under either the proposed action (Alternative 1, 2010 FMP) or the no action (Alternative 2, 2005 FMP) alternative.

Wetlands that would potentially be affected by planned fire management actions are riparian wetlands along the banks of perennial streams. There are no other naturally occurring wetlands in the park in areas where wildfires are likely or that would be affected. Impacts on riparian wetlands from fire management actions under either the proposed action (Alternative 1, 2010 FMP) or the no action (Alternative 2, 2005 FMP) alternative are primarily indirect effects on riparian wetlands because actions have been designed to avoid riparian areas.

Indirect effects on riparian areas under the proposed action (Alternative 1, 2010 FMP) are similar to those under the no action alternative (Alternative 2, 2005 FMP). Effects on riparian areas and floodplains under Alternative 3 (suppression only) have the potential to be more severe depending on the location of the fire in relation to perennial streams or riparian areas, and the intensity of the fire. Catastrophic fires and associated suppression actions have the potential for significant adverse effects on floodplains and riparian zones related to erosion of burned areas in the first rainy season following the fire.

Prescribed fires, preparation for fire suppression including preparation of roads and water sources, and fuel reduction activities would have negligible short-term effects on riparian wetlands, but long-term minor to moderate beneficial effects if these activities prevent catastrophic wildfires or reduce the severity of smaller wildfires in the vicinity of perennial streams.

Prescribed fire will be used to treat approximately 6800 acres under the proposed action (Alternative 1, 2010 FMP) or 4600 acres under the no action (Alternative 2, 2005 FMP) alternative. Distances to intermittent or perennial streams for prescribed burn units under the proposed action are listed in Table 2. No units contain a perennial stream within the unit boundaries. Copper Creek is within 150 feet of the boundary of the Wildcat prescribed fire unit under the proposed action.

No shading riparian vegetation would be removed during fire line construction. Only understory shrubs and trees and low hanging branches would be removed.

All five shaded fuel breaks constructed or maintained under the proposed action (Alternative 1, 2010 FMP) or under the no action (Alternative 2, 2005 FMP) alternative are located along ridge tops well away from any stream course or are at least 300 feet from the nearest perennial stream. No piles would be burned within the riparian area (300 feet) of any intermittent or perennial stream.

Cumulative Effects on Floodplains and Wetlands

The watershed restoration program to remove old logging roads has short-term negligible to minor adverse effects on riparian zones associated with streams that are adjacent to or buried under roads that are removed or treated to reduce long-term soil erosion and sedimentation of streams. The cumulative effect on riparian wetlands from proposed fire management activities is negligible compared to the adverse effects on riparian wetlands and floodplains from past logging and associated road construction and the benefits to riparian wetlands and floodplains from watershed restoration activities.

Conclusions (Effects on Floodplains and Wetlands)

Proposed fire management actions under the proposed action (Alternative 1, 2010 FMP) or under the no action (Alternative 2, 2005 FMP) alternative would have negligible adverse effects on floodplains and riparian wetlands. Potential adverse effects on riparian wetlands under Alternative 3 (suppression only) would be mitigated by best management practices intended to prevent direct adverse effects beyond those that might result from a wildfire.

EFFECTS ON VEGETATION

Effects on vegetation from suppression of wildfires are the same under all alternatives. Effects on vegetation from planned fire management activities include direct effects on vegetation from prescribed burns, preparation for prescribed burns, construction and maintenance of shaded fuel breaks, fuel reduction to protect historic structures, from wildfires, and from suppression of wildfires. Effects on vegetation from planned fire management actions are similar under Alternative 1 (2010 FMP proposed action) and Alternative 2 (2005 FMP, no action).

Under Alternative 3 (suppression only), effects on vegetation are direct from wildfire that is being suppressed, from construction of fire lines, and from suppression actions. It is not possible to predict the acreage of vegetation that might be affected by wildfire and associated suppression.

Prescribed fire would be used to treat approximately 6,800 acres under the proposed action (Alternative 1, 2010 FMP) or 4,600 acres under the no action (Alternative 2, 2005 FMP) alternative. Under proposed action (Alternative 1, 2010 FMP), prescribed fires are planned for 15 acres of grassland; 250 acres of pine woodland in the Little Bald Hills; 4,900 acres of oak woodlands mostly in the Bald Hills; 184 acres of coastal grass and shrub; and 1,438 acres of second growth forests in the Bald Hills area. Under the no action alternative (Alternative 2, 2005 FMP), prescribed fires would be implemented in 50 acres of pine woodland in the Little Bald Hills; 4445 acres of oak woodland in the Bald Hills; 60 acres of coastal grass and shrub; and 45 acres of second growth forest.

Under Alternative 1 (2010 FMP proposed action), shaded fuel breaks would affect about 468 acres of vegetation. Under Alternative 2 (2005 FMP, no action), about 416 acres of vegetation would be affected for construction or maintenance of shaded fuel breaks.

Vegetation removal through cutting and burning would be considered a direct adverse effect on vegetation. These effects are localized around the perimeters of prescribed fire units and structures, including historic structures. There would be short-term recurring effects to vegetation from

prescribed fire, from preparation of fire lines for prescribed fires, from annual clearing on road corridors and around structures, and for preparation of water sources. This vegetation would be cleared on an annual basis as needed. All vegetation that would be removed under the proposed fire management actions is common in the parks and the region. Brush and trees affected are common in the parks and routinely removed or cut annually for general maintenance of roads, trails, and facilities.

Construction of shaded fuel breaks involves cutting trees less than 12 inches dbh, brush, and tree limbs that could provide ladder fuels along a 100 foot wide strip along either side of roads or around building complexes. All attempts would be made to leave all trees less than 12 inches dbh that have broken or deformed tops as these may develop into wildlife habitat. Trees that would be removed are primarily Douglas-fir and red alder. Canopy cover would be maintained above 60%. Cut trees and limbs would be piled on roads within the unit or away from live trees and large logs and snags (i.e. logs greater than 36 inches diameter on the wide end and longer than 10 feet and snags larger than 24 inches dbh). Cut vegetation would either be burned during the wet season outside of the burn timing restrictions or chipped with a mechanical chipper outside of the noise restrictions periods.

Preparation activities for prescribed fires and for suppression actions can occur at anytime in these burn units but generally occur in early summer for prescribed fires. Burns would occur between the time when grass or brush cures (generally mid-July) and the end of the burn season when ignition cannot be achieved because of damp fuels.

Preparation methods include cutting grass with line trimmers and mowers along fire lines, fire line construction with chainsaws and hand tools, installation of fire hoses and setting up and filling portable water tanks at strategic locations. Fire line construction would vary according to fuel type and time of year to ensure firefighter safety and allow for control of the prescribed fire. Burns completed late in the year that are dependent upon precipitation would utilize “wet” lines of either naturally occurring forest edge fuel moisture changes or through the direct application of water to vegetation prior to ignition. Where fire lines are constructed they would be dug with hand tools to mineral soil to a width of no more than four feet and rehabilitated after the prescribed burn by replacing the topsoil. In grasslands, additional fuels adjacent to the fire line may be mowed. In oak woodlands or areas bordered by dense, young conifers, ladder fuels near the ground that could allow fire to move higher into the forest canopy would be cleared by cutting back brush and trees less than 18 inches dbh and removing lower limbs.

Fire lines in grasslands may be mowed wider than 4 feet. In oak woodlands or areas bordered by dense young conifers, adjacent ladder fuels would be cleared by cutting back brush and removing lower limbs and small diameter seedlings or pole-sized trees. In second growth units, pole-sized trees within four feet of fire lines may be cut and limbs of larger trees removed up to six feet above ground. No conifers greater than 18 inches dbh would be cut in any unit. In units with established roads, feller-bunchers or similar heavy equipment might be used to fell trees along road sides, rather than using hand crews with chainsaws. Cut trees large enough to be suitable as firewood would be hauled to areas along park roads, cut into lengths, and stacked for removal under permits to be issued by the

park. Debris would be scattered within a prescribed burn unit when feasible or hand piled and burned during the winter wet season in areas of heavier accumulation.

Vegetation would be cleared around four existing ponds originally constructed as water sources for livestock or logging operations to improve access by fire equipment and vehicles, and maintain them as firefighting water sources for either prescribed fires, wildfires or both.

Creating and maintaining the ponds entails clearing three-foot-wide paths through underbrush and sapling trees with chainsaws to provide access for water suction hoses, portable pumps and associated hoses and operators.

To prepare and maintain the M Line pond for emergency use by water trucks and helicopters, red alder saplings and brush growing along the banks of the pond and a swath of sapling alders and brush approximately 20 feet wide by 150 feet in length from the pond to the nearby Upper B Line Road would be cleared to enable a helicopter carrying a water bucket to safely dip water from the pond and approach and leave the pond without becoming ensnared in the re-growing alders.

Since 1992, more than 60 prescribed burns have been conducted in the Bald Hills. Most prescribed burns had some component of oak woodlands in the burn unit. Prescribed burns conducted in the Bald Hills are typically cool, leaving a mosaic of burned and unburned vegetation. All shrub species, even when top-killed, sprouted following the burns. Douglas-fir less than ten feet tall were killed when at least 70% of the foliage was scorched. All sampled oaks under ten feet were top-killed but sprouted whereas oaks taller than ten feet suffered little damage and produced few sprouts. Unburned oak plots had 35% background level of sprouting, mainly in small size classes but burned plots experienced 58% sprouting (Sugihara et. al. 1987a). The amount of sprouting varied with fire intensity, size, and whether the tree was alive or dead at the time of the burn or was killed during the fire. Little sprouting was noted after a low intensity prescribed burn but considerable sprouting occurred following two higher intensity fires. Preliminary results following one of the high intensity prescribed burns show sprouting occurred in 50% of the surviving trees and 82% of the top-killed trees. Oaks under 9.5 inches (24 centimeters) dbh were sometimes top-killed but sprouted vigorously. Oaks over 9.5 inches dbh were rarely affected although some trees as large as 15 inches (38 centimeters) were occasionally top-killed, then resprouted. Prescribed burning-induced mortality accelerated patterns of self-thinning seen in unburned stands by increasing the mortality by 19% mainly in the small size classes. The net effect of fire on stand structure appears to be reduction in small size classes and the formation of a new size class by fire-induced sprouting. Preliminary results of a small study show that 47% of the oak seedlings also sprouted following a low intensity prescribed burn.

Although fire can kill individual oak trees, it is important for persistence of oak stands under natural conditions, especially in areas where taller, more competitive conifers are invading (Plumb and McDonald 1981; Sprague and Hansen 1946; McCulloch 1940; Silen 1958; Taylor and Boss 1975). In RNSP, oak woodlands that have been burned on a three-to-five year rotation, such as the Schoolhouse Peak burn unit, are free of encroaching conifers, and do not exhibit the dense, post-fire closed-canopy single stem form typical of more intensely burned woodlands (Leonel Arguello, RNSP supervisory

botanist, personal observation). A few areas of oak woodlands burned since 1992 have been high intensity burns that resulted in top kill of oak trees. These hotter fires were the result of elevated fuel loadings from other management activities such as conifer cutting to reduce encroachment. A large percentage of these top killed oak trees have basally or epicormically resprouted. Within the Bald Hills, prescribed burning has not caused overt landscape level changes in oak woodland canopy structure. Long-term evaluation of seedling/pole-sized tree growth is part of the vegetation management program in the Bald Hills.

Douglas-fir and brush that are not killed by cutting or fire would continue to grow and would be removed annually. All old growth trees within any prescribed fire unit would be protected from prescribed fire by having fuels around the base removed. Oregon white oak would be protected by prescribed underburning at low temperatures. Trees that are contributing elements to significant cultural landscapes would be protected by removing adjacent heavy fuels and with fire lines.

Grasses, low shrubs, and small Douglas-fir would be consumed by prescribed fire. Removal of Douglas-fir would benefit the native plant community by removing trees that shade and crowd out the native grasses, shrubs, and Oregon white oaks. Removal of non-native grasses would benefit native plant species. The native grasses evolved with natural ignitions as an ecological process. Restoration of fire would recreate ecological conditions that favor the native grasses. There would be a long-term benefit to the native plant community from prescribed fire that enhances the survival of native species and removes non-native species. The intensity of beneficial effect on the native plant species composition would have a minor short-term effect over a few decades. Repeated prescribed fire would have a moderate long-term benefit. It would be considered a significant benefit to native plant communities in the Bald Hills if repeated application of fire results in a complete removal of non-native plant species. It is unlikely that non-native plant species would ever be completely eliminated because there would be continual reintroduction of non-native grasses and other plants from adjacent private lands from seeds carried by wind, animals, and vehicle traffic along the Bald Hills Road.

The Little Bald Hills prescribed fire subunit contains large mature overstory trees surrounded by dense fuels. Ladder fuels around the base of large trees and trees less than 12 inches in diameter would be removed around the overstory trees in the unit to reduce the intensity of fire that might burn hot enough to kill the trees. The Little Bald Hills contains vegetation associations unique to the parks as well as rare plant species that are associated with serpentine soils. The Jeffrey pine, knobcone pine, and Idaho fescue associations are thought to be fire-dependent to some extent. Prescribed fire would enhance the vigor and long-term persistence of the fire-dependent plant associations.

Under Alternative 3 (suppression only), there would be no direct effects on vegetation from prescribed fire or fuel reduction projects. The likelihood of wildfire moving out of one vegetation type into another, such as from grasslands into second growth forest, would increase. The greatest effect on coniferous forests in the park would result from a catastrophic wildfire. The potential for catastrophic wildfire would increase over the long-term from full suppression of wildfires without accompanying fuel reduction. Fire would continue to be excluded from the oak woodlands and grasslands in the Bald Hills and from the Idaho fescue grassland, knobcone pine, and Jeffrey pine plant communities. The latter are thought to be fire-dependent based on the fire regime in these

communities elsewhere. The Bald Hills plant communities are being replaced by conifers that are reducing the extent of oak woodlands and grasslands. Exclusion of fire from the Bald Hills and Little Bald Hills has allowed the native species to decrease in abundance and the plant communities to change as other species increase. These plant associations in Bald Hills and Little Bald Hills would gradually be replaced over a several hundred years as the fire-dependent species die out.

Cumulative Effects on Vegetation

The lack of fire in old growth redwood forests may be causing subtle changes to species composition and stand structure. Changes to species composition and stand structures may be occurring more rapidly on ridges and near ethnographic landscapes because fire was used more frequently in these locations than on alluvial flats or interior forests. Given the long intervals between naturally ignited fires in redwood forests, it is unlikely that fire suppression since the 1930s has had a significant effect on alluvial redwood stands within RNSP. Flooding in this zone is a more common occurrence than fire. However the natural fire return interval has been exceeded in upland interior stands. The lack of fire in these upland stands favors establishment of fire-intolerant species in the forest understory. A stand of dense second growth forest along the Bald Hills Road shows a significant amount of tanoak and hemlock in the forest understory that is not present in adjacent old growth redwood forests. Shrub vegetation also appears to be expanding in some areas of old growth forests, perhaps creating ladders for fire to carry upwards towards the canopy. Fire history research in park forests is being initiated to determine the long-term effect on old growth forests from changing the fire regime from relatively frequent fires to fire suppression.

The cumulative effect of vegetation removal associated with the proposed fire management actions under Alternative 1 (2010 FMP proposed action) or under the no action alternative (Alternative 2, 2005 FMP) would be negligible over the life of the plan but would occur over the long-term with other recurring vegetation management projects throughout the parks.

Vegetation is removed for watershed restoration projects that involve removal of several miles of abandoned logging road. Because watershed restoration focuses on watersheds damaged by logging, the vegetation that is removed generally does not include trees over 50 years old. Residual old growth and mature trees are not removed for watershed restoration. Watershed restoration in the park requires removal of vegetation growing on and adjacent to old road fill and landings that has regrown after clearcut logging. The effect on vegetation from the Lost Man Creek watershed restoration project due to be completed in fall 2010 would be localized on 216 acres of second growth forest on and along roads that are being removed. This would be a negligible to minor adverse effect because the vegetation to be removed has grown back following logging and road construction that destroyed the original vegetation community. There would be an indirect long-term benefit to vegetation from enhancing soil formation processes by recovering and repositioning buried topsoil, and a direct minor long-term benefit to vegetation from recovering the original seedbank in the topsoil. The overall effect on vegetation from the Lost Man Creek watershed restoration project and other future watershed restoration projects would be adverse from removal of vegetation (short-term for annual plants and shrubs but longer-term for long-lived trees) but that effect would be negligible to minor because the original vegetation was already cleared for road construction and logged in the adjacent areas.

Management of second growth forests to accelerate the development of forest characteristics that more closely resembles the species composition and density of old growth forests prior to logging and to reattain other ecological and aesthetic attributes of old growth forests was initiated in 2009. All trees that are removed for second growth forest management are primarily Douglas-fir less than 50 years of age. The second growth forest stands are the result of logging prior to establishment and expansion of the national park, and are considered to represent an impaired resource compared to the unlogged old growth forests that the parks are intended to preserve. The 48,300 acres of previously clearcut second growth forests in the national park that are not treated under the second growth management program would remain in a degraded condition. Logged areas of the parks would continue to recover although the recovery in some dense second growth stands that were not thinned after replanting would require centuries to reattain characteristics and functions associated with old growth forest. This is a significant adverse effect on old growth redwood forest communities that would continue for centuries without active management.

Vegetation along roads and trails throughout the parks, including access roads used for fire management, would be brushed under the regular maintenance program. This would be a localized but widespread adverse effect on vegetation that is repeated over the long-term. The adverse effect is negligible because the vegetation is common in the park and throughout the region and regrows quickly, and was significantly altered by logging and road construction.

Cumulative effects on vegetation in the Little Bald Hills are related to management of Port-Orford-cedar (POC) to prevent continued infection and spread of POC root disease. The NPS has adapted protocols developed by the US Forest Service (USFS 2004) and the Bureau of Land Management (BLM 2004) in southwestern Oregon and northwestern California for reducing the spread of the disease to uninfested areas in the parks. The protocols include rerouting and improving trails through areas with Port-Orford-cedar to keep trail users from contacting and moving infested mud; removal of dying trees less than 15 inches dbh from areas where humans might move spores to uninfested areas; cleaning equipment, vehicles, and footwear that might have contacted infested mud; using uninfested water for fire suppression in POC areas; and avoiding uninfested areas after crossing or working in infested areas. All work in the Little Bald Hills follows these protocols to avoid spreading root disease. In case of wildfire, protecting human life and property will take precedence over protecting POC.

Sudden Oak Death (SOD) is a pathogen related to the pathogen that causes Port-Orford-cedar root disease and is spread in a similar manner from spores in water and wet soils that are typically moved by humans. SOD affects tan oaks, rhododendrons, California bay, and other important components of the park vegetation communities. SOD is not yet known within park boundaries but is known to occur both north and south of the park. The NPS is developing a program to deal with SOD when it inevitably reaches the park. The long-term effects of SOD on park vegetation are unknown but SOD has had significant adverse effects on oak woodlands in national and state parks in central California and the San Francisco Bay Area. SOD-killed trees have produced a significant increase in hazardous fuel accumulations in areas in central California.

In a wildfire emergency, it is possible that Freshwater Lagoon would be used for dipping by helicopters. Water from Freshwater Lagoon would only be allowed in areas where the water cannot reach free-flowing park streams in order to avoid spread of invasive exotic plants and mollusks known to be present in Freshwater Lagoon.

Conclusions (Effects on Vegetation)

The proposed fire management actions under both the proposed action (Alternative 1, 2010 FMP) and the no action alternative (Alternative 2, 2005 FMP), including reduction of hazardous fuel levels and preparation for suppression actions, are intended to reduce the long-term potential for wildfire, particularly catastrophic wildfire, and to prepare for more effective suppression in a short a time as possible. Without these proposed actions, the long-term potential for wildfire would increase. Catastrophic wildfire would have adverse effects on vegetation that would range from moderate to severe, depending on the extent of the fire.

A wildfire in the Bald Hills grasslands and oak woodlands or the Little Bald Hills would have a greater short-term and long-term adverse effect on vegetation because a wildfire is likely to become much larger than any prescribed fire unit and would destroy a much larger area of a plant community that is uncommon in the park and the region. The adverse effect of a wildfire on the Bald Hills grasslands and oak woodlands or the Little Bald Hills would be moderate to significant.

Under the proposed action (Alternative 1, 2010 FMP), approximately 6,800 acres would be treated with prescribed fire and 468 acres would be affected by construction or maintenance of shaded fuel breaks. Under the no action alternative (Alternative 2, 2005 FMP), approximately 4,600 acres would be treated with prescribed fire and 416 acres would be affected by construction or maintenance of shaded fuel breaks. These effects on vegetation would be considered adverse over the short-term to extent that vegetation is removed, but beneficial over the long-term from removal of undesirable species such as small conifers that are encroaching into grasslands and oak woodlands. The adverse effects on vegetation from prescribed fire and shaded fuel breaks would be negligible because the vegetation that is removed is undesirable or is common in the park and the region and is routinely removed for other projects.

There would be a long-term benefit to native plant communities from prescribed fire that enhances the survival of native species and removes non-native species. The intensity of beneficial effect on the native plant species composition would be minor for a few decades. Repeated prescribed fire would have a moderate long-term benefit to plant communities in prescribed fire units in the Bald Hills and Little Bald Hills. The NPS would continue efforts to plan for protection of native plant communities from introduction of non-native plants and introduced plant pathogens such as SOD and Port-Orford-cedar root disease that are spread by human activities, especially along transportation routes and other developments adjacent to the park.

EFFECTS ON WILDLIFE

Fire management actions under either Alternative 1 (2010 FMP proposed action) or Alternative 2 (2005 FMP, no action) would be similar. There would be potentially greater effects on wildlife under Alternative 1 because 6,800 acres would be treated with prescribed fire compared to 4,600 acres in

prescribed fire units under Alternative 2. There would be no direct effects on wildlife from planned actions under Alternative 3 (suppression only). Direct effects on wildlife under the suppression only alternative would be similar to direct effects on wildlife from prescribed fires under Alternatives 1 and 2 and from suppression of wildfires under these alternatives.

Measures to protect endangered species from fire management activities, including suppression, would protect other wildlife in the vicinity. Endangered species protections include timing restrictions to avoid disturbance from noise and smoke during the breeding and nesting season and restrictions on size of vegetation cut to protect nesting (birds), denning (mammals), and foraging habitat.

In prescribed burn units, some small relatively sedentary animals such as insects, salamanders, snakes, lizards, shrews, mice, and gophers would be killed by fire. Some individuals that live close to the perimeter of a burn unit would be able to escape direct injury from a prescribed fire by moving out of the fire zone. Other individuals would be able to move out of the fire path but would be exposed to an increased threat of predation. Hunting success for predators including insectivorous birds, raptors, and small and medium-sized mammalian carnivores such as weasels, gray foxes, coyotes, and bobcats would increase in the area surrounding a burn unit as prey items move away from an active fire or become more visible from removal of vegetation cover.

Preparation for prescribed fires and fuel reduction projects remove snags and dead and downed wood in addition to live standing vegetation and large brush. Snags, hollow trees, and large downed logs are used by cavity-nesting birds and small and medium-sized mammals including rabbits, bats, rodents, and carnivores. To preserve habitat for these animals during prescribed burning, snags larger than 36 inches dbh and downed logs greater than 36 inches dbh and 10 feet in length on the edges of prairies or within oak woodlands would be protected to the greatest extent practicable.

Fire management actions under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would have short-term adverse effects on some species of wildlife in localized areas. The overall effect on wildlife populations would be negligible in the short-term when these activities are implemented but would recur on an annual basis. The long-term effect of fire management activities on those populations of wildlife would be negligible, although there would be greater adverse short-term effects on some populations of small sedentary wildlife in the prescribed fire units in the Bald Hills where the majority of prescribed fires would occur. These adverse effects would be minor to moderate on populations of insects and other invertebrates, on lizards, and on small mammals that live in the center of the burn units. Some wildlife species would benefit in the short-term from prescribed fires. Elk and deer would benefit from the increase in growth of browse species that would be available on burned areas. Other wildlife including raptors and small mammalian predators would be able to locate prey more easily in burned areas. Some prey species such as grasshoppers would increase following a burn, benefiting insectivores such as kestrels. Other predators would benefit from an increase in prey density if prey items have to move out of the burned area. These benefits to some species of wildlife would be temporary, localized, and short-term but would be repeated for each prescribed fire. There would be a long-term indirect benefit from the persistence of wildlife communities in the grassland and oak-woodland plant community.

Roosevelt elk inhabit the coastal areas around Major Creek and Enderts prescribed burns units. Prescribed fire at Major Creek would improve the quality of elk browse as plants regrow after the fire, under both Alternative 1 and Alternative 2 (2005 FMP, no action), and on elk at Enderts Beach under Alternative 1 (2010 FMP proposed action). This would be minor short-term benefit to some elk that would persist as long as prescribed burns are conducted. Deer would also benefit from an increase in browse plants following prescribed fire in coastal areas.

In a wildfire emergency, it is possible that Freshwater Lagoon would be used for dipping by helicopters. Water from Freshwater Lagoon would only be allowed in areas where the water cannot reach free-flowing park streams in order to avoid spread of invasive exotic plants and mollusks known to be present in Freshwater Lagoon.

Cumulative Effects on Wildlife

Other park resource management programs that affect wildlife include watershed restoration, second growth forest management, and control of non-native plants. Watershed restoration occurs in corridors along old logging roads and involves removal of trees that have regrown following logging. Restoration removes habitat for certain wildlife species in localized areas and increases habitat for some predator species. Some individuals would be unable to find new suitable habitat but the loss of these individuals would not adversely affect the long-term persistence of the population. Management of second growth forests would also involve removal of small trees but most of the trees and the forest stands are poor quality wildlife habitat, and there would be a long-term benefit as the forest reattains conditions more typical of unlogged forests.

The cumulative effects on wildlife from proposed fire management actions in the short-term would be adverse, localized, negligible for most actions, and minor in prescribed burn units. In the long-term, the cumulative effect on wildlife from proposed fire management actions would be beneficial to the extent that the proposed actions prevent or reduce the intensity of wildfires and maintain or restore native plant communities. The degree of effect from prevention of wildfires depends on the intensity and extent of the wildfire. The effects of wildfire in the coniferous forests would depend on the forest type. Wildfires in the old growth forest are more likely to be less intense and smaller than in dry dense second growth stands. Some overstocked second growth forests that were never thinned following commercial timber harvest are not good quality wildlife habitat. Catastrophic wildfire in these forests would have a less severe effect on wildlife than in other second growth forests that have greater tree and plant species diversity and forest structure that more closely resembles unharvested forest. A wildfire in the Bald Hills grasslands and oak woodlands or the Little Bald Hills would have a greater short-term and long-term adverse effect on wildlife because a wildfire is likely to become much larger than any prescribed fire unit and would destroy a much larger area of a habitat type that is uncommon in the park and the region. The adverse effect of a wildfire on wildlife in the Bald Hills grasslands and oak woodlands or the Little Bald Hills would be moderate to significant.

Conclusions (Effects on Wildlife)

Wildfires, particularly catastrophic fires, would have direct long-term adverse effects on smaller wildlife species within the fire perimeter. The effects would vary from minor to severe depending on

the size and intensity of the fire and the species affected. Less severe wildfires would have a short-term benefit for a few decades on some species of wildlife such as cavity-nesting birds that use burnt snags, elk and deer that browse on new growth that resprouts from some plants after fires, and some animals such as certain chipmunks that favor more open habitats over dense forests. Catastrophic wildfires have the potential for significant short-term adverse effects on park wildlife populations from direct effects due to loss of many individuals and long-term indirect effects due to loss of habitat. The adverse effects of catastrophic wildfire would be greater than the benefits to some wildlife species in the decades following a catastrophic fire from the loss of habitat.

Under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP), short-term adverse effects on individual animals from fire management actions would range from negligible to minor. Long-term benefits to wildlife from prevention of catastrophic wildfires would be significant, to the extent that fire management actions prevent catastrophic wildfires, and minor to moderate long-term benefits from restoration and maintenance of natural vegetation communities.

EFFECTS ON SENSITIVE, THREATENED, AND ENDANGERED SPECIES

Western lily, Oregon silverspot butterfly, mardon skipper, northern spotted owl, marbled murrelet, and Pacific fisher, Coastal California Chinook salmon, Southern Oregon Northern California Coastal coho salmon, and Northern California steelhead are listed as threatened or endangered species or are candidates for listing that may occur in areas affected by fire management activities or be affected by fire management activities under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) (NPS 2004c, 2009 b,c).

There are also potential impacts on these species from suppression actions under Alternative 3 (suppression only) but these effects cannot be analyzed because the location of wildfires cannot be predicted. Effects of suppression would be analyzed through incident-specific consultations with the USFWS or NOAA Fisheries after the fire emergency has passed. Over the long-term, the suppression only alternative has the potential for moderate to significant adverse effects as fuels increase the potential for catastrophic wildfire in the absence of prescribed fire and mechanical fuel reduction around prescribed fire units and in shaded fuel breaks.

Fire management actions under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) have the potential to affect listed birds that occupy old growth or second growth forests including northern spotted owl, marbled murrelets, and bald eagles; migratory birds that nest in small trees or large brush; Pacific fishers that den and rest in forested areas; and mardon skippers that lay eggs in the Idaho fescue grasslands in the Little Bald Hills. These animals would be affected by removal of trees, logs and snags used for nest and den sites; from drifting smoke; from noise and disturbance from personnel and equipment used for suppression including helicopters; and noise and disturbance from preparation for suppression and for prescribed fires including installing water tanks, constructing fire lines, preparing access roads, and removing hazardous fuels. Table 2 lists prescribed fire units and whether habitat for a listed or candidate wildlife species would be affected under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP).

Both the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) have similar effects on threatened and endangered species. These effects have been documented in the biological assessments (NPS 2004c, b, 2009 b,c) and resulting biological opinions from the USFWS and NOAA Fisheries.

Sensitive Plants, including Western Lily—All project areas with suitable habitat would be surveyed for rare plants, including western lilies. The two primary mitigation measures for rare plants are avoidance if at all possible and conducting the project outside the flowering or main growth period of the plant. Park botanists would survey areas where fire lines would be constructed around prescribed fire units or where vegetation would be cut, piled and burned for hazard fuel reduction or to establish shaded fuel breaks. Any such plants that are found within project areas would be marked and protected from disturbance. If sensitive plants are present within the project area, hand lines, or burn piles would be moved to avoid the individual plants if possible especially during flowering. The majority of sensitive plants occur in the serpentine areas of the parks near Hiouchi and the Little Bald Hills.

Fire management activities under the proposed action (Alternative 1, 2010 FMP) within the DeMartin, Lagoon Creek, Enderts, and Major Creek prescribed burn units have the potential to temporarily modify 306 acres of suitable western lily habitat or injure individual plants. Under no action (Alternative 2, 2005 FMP), about 45 acres of suitable lily habitat in the Major Creek and DeMartin prescribed burn units would be affected. Prescribed burning in coastal scrub may beneficially affect western lilies by improving habitat conditions through the reduction of encroaching over story vegetation and the retention of more open, coastal scrub type habitat.

Oregon Silverspot Butterflies— Fire management activities under the proposed action (Alternative 1, 2010 FMP) could affect Oregon silverspots. The only suitable habitat for Oregon silverspots identified in RNSP is the marine-influenced grasslands immediately to the east of Crescent Beach where the Enderts burn unit is located. Silverspots have never been detected in the park during past surveys, but the burn unit would be surveyed prior to unit preparation and ignition and again after the burn the following year. If silverspots are detected prior to the prescribed burn, then the park will not burn the unit and will reconsult with the USFWS. The burn may improve habitat suitability by improving conditions for host plants through the reduction of exotic plants.

Mardon Skippers—The preparatory work and prescribed burning in the Little Bald Hills under either the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) may adversely affect some mardon skippers over the short term and beneficially affect skippers over the long-term by improving the quality and quantity of habitat.

Lack of fire has probably allowed forest encroachment and a corresponding decrease in fescue grass areas that are the primary habitat for skippers. A continued lack of fire would most likely result in a further decline in the amount of suitable fescue grassland skipper habitat. Prescribed burning is intended to have a beneficial effect on skipper habitat over the long-term from reducing forest encroachment.

Preparatory work including felling and piling of encroaching conifers in very localized areas; piling slash for pile burning; pile burning; and prescribed burning would not occur during critical life stages (May 1–September 30). Some individual caterpillars could be disturbed by foot traffic and hand tools during preparatory work and prescribed burning. Slash would be preferentially piled on existing brushy vegetation rather than on fescue grass patches to avoid destroying grass plants on which butterflies feed and lay eggs. No fire lines would be constructed; the wet forest/grassland interface would be used as the burn boundary.

Broadcast burns in the Little Bald Hills unit under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) are planned as extremely rapid low intensity burns to eliminate some invading Jeffrey pines and shrubs and enhance fescue grass growth and to maintain and in some instances expanding the available habitat for mardon skippers.

The fescue bunch grass provides very little fuel and would be burned after the first rains to ensure a low intensity burn. Some skipper caterpillars are expected to survive the prescribed burning because they would be deep within the bases of the grasses where little to no burning occurs. Some individuals would be injured or killed. The fescue grass bases should sprout new growth during the winter rainy season following the burn and should be available as skipper caterpillars become active and begin foraging the following May.

Effects of smoke on butterfly larvae in diapause are unknown. Any effect is expected to be of short duration because the short fescue bunch grasses within the unit will burn quickly and the units contain very little down woody debris which could smolder for longer periods.

Under the proposed action (Alternative 1, 2010 FMP), the Little Bald Hills prescribed burn unit would be treated using an adaptive management model to protect the mardon skipper population and enhance the habitat. Burns would be limited to approximately 50 contiguous acres in a given year. Each 50-acre block within the 1,470 acre burn unit would be burned only once over the five year life of this plan (250 acres total in five years) to provide refuge areas from which mardon skippers can repopulate burned areas. The mosaic burn pattern that provides refugia is recommended (Pickering 1995) for management of habitat of rare invertebrates. In any year, the prescribed burn blocks of a maximum 50 acres would temporarily alter about 15% of the approximately 346 acres of suitable skipper habitat available within the RNSP portion of the Little Bald Hills fescue grasslands. A maximum of 72% of the total suitable habitat would be burned under the proposed action over the 5-year life of the plan. The burned grasslands would recover and be suitable for skippers to reoccupy by the following year. The relatively wide distribution of mardon skippers in the Little Bald Hills prescribed burn unit would ensure that most of the population would not be affected during any given year.

The adaptive management approach in the Little Bald Hills includes a vegetation monitoring program to determine if the fescue grass is recovering after a prescribed fire in addition to pre- and post-burn skipper monitoring. If the grass or butterfly numbers do not recover as quickly as expected, then burning would cease and park resource managers would reassess the temporal and spatial arrangement of the burn blocks. If monitoring reveals a measurable drop in the distribution of

skippers after a block is burned, no burning would occur the following year and RNSP biologists and botanists would develop a new proposal in consultation with the USFWS and butterfly experts.

Under no action (Alternative 2, 2005 FMP), the same 50-acre block would be burned throughout the life of the plan if there are no measurable drops in skipper distribution and fescue populations. This would have the same short-term effects as under the proposed action but would not provide long-term benefits to the mardon skipper population because fire as a natural process would continue to be excluded from the remaining grassland habitat. In areas where fire is excluded, conifers would continue to encroach, fuels would build up with an increasing potential for catastrophic wildfire, and the fescue population would slowly decline.

Under Alternative 3 (suppression only), there would be no long-term benefit to mardon skippers as Idaho fescue grassland habitat continues to be lost to forest encroachment. As fuels continue to increase without active management in the form of prescribed fire, the potential would increase for major loss of skipper habitat due to wildfire and associated suppression activities.

Anadromous Salmonids (Chinook and coho salmon, steelhead trout)—None of the planned actions under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would have direct adverse effects on listed fish species. Wildfire suppression guidelines (all actions, including the proposed action and no action) attempt to limit the use of fire retardant to areas more than 300 feet from perennial streams to the extent practicable and within aircraft safety requirements.

Most planned fire management activities do not have the potential to affect fish because they would not occur in the vicinity of fish-bearing perennial streams. Work near anadromous fish-bearing streams during spawning seasons would be restricted to prevent visual disturbance to spawning salmon and trout. Best management practices would be used to avoid sediment delivery into streams from any activity needed for rehabilitation of burned areas after suppression of wildfires. These practices include use of silt screens, work only during dry periods or when the soils are not saturated, no refueling of construction equipment within 150 feet of a stream, a fuel spill prevention plan for fueling and use of on-site equipment, use of weed-free straw on exposed soils if needed until revegetation is complete, and stabilization of any structures within the inner gorge of streams to prevent bank erosion.

Under the proposed action (Alternative 1, 2010 FMP), the five shaded fuel breaks, seven historic structures, and four holding tanks are not within 300 feet of any perennial stream. Construction, preparation, installation, and maintenance for these activities and facilities would not affect listed salmonids or their habitat. The holding tanks would be filled by rainwater so there would be no effect on streams from filling the tanks. Under the no action alternative (Alternative 2, 2005 FMP), there are no fish present at any of the identified diversion points for the three stream-filled holding tanks, all of which are located high in the watershed.

Vegetation clearing around the four water source ponds under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would not affect listed salmonids because the ponds are located near ridge tops and are well upslope from any anadromous reaches of any streams.

Table 2 lists the prescribed fire units that would be burned under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP).

Prescribed burns at DeMartin, Enderts, Lagoon Creek, and Major Creek under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would have no effect on listed salmonids because these units are not located in watersheds with anadromous fish.

Prescribed burns in Airstrip Upper, Dolason Lower, Dolason Upper, Eastside, Elk Camp Upper, Gans Lower, Gans Upper, Holter Ridge Beargrass, Lyons Upper, Maneze, School House, Tick, Upper K&K, Williams Ridge, and Wooden Gate units are all located at or near ridgetops. Burning in these units would not affect on listed salmonids because no perennial streams are within 300 feet and no intermittent streams are within 100 feet of the burn unit; intervening unburned vegetation and downed woody material would prevent any ash from being transported into any stream course.

Airstrip Lower, C-10, Child’s Hill, Copper Creek, Counts Upper, Counts Lower, Coyote Creek, Davison, Dooleyville, Elk Camp Lower, Little Bald Hills, Lower Lyons, Mainstem, Mid Basin, and South Boundary prescribed fire units have intermittent streams within 100 feet or perennial streams within 300 feet. Potential adverse effects to fish-bearing streams from ash or sediment from prescribed burns are anticipated to be negligible because only the top stalks of grass would be burned, leaving leaf bases and root stalks intact. Vegetation recovery within these vegetation types occurs within one season. Anecdotal observations of intermittent streams in or adjacent to these burn units indicated negligible amounts of ash transport or sedimentation after prescribed burning.

Indirect effects on listed fish from prescribed fires and construction of fire lines in some units from sedimentation that might affect streams occupied by listed fish are anticipated to be negligible. Most of the fire lines would be mowed grass, wet lines, or forest edges that do not expose any bare soil. Hand lines would be rehabilitated immediately after prescribed burning to reduce the potential for erosion and runoff into streams.

Sediment from either ash or disturbed soils may wash into fish-bearing streams if initial rains occur immediately after prescribed burns at Pig Pen and Wildcat units.

Table 3—Sensitive Species Habitat Affected by Prescribed Burns

Burn Unit Name	Total Area (acres)	Vegetation Type	Within, immediately adjacent to or within 500 feet of suitable endangered, threatened or candidate species habitat? (acres within suitable habitat to be burned)			
			Northern Spotted Owl	Marbled Murrelet	Pacific Fisher	Other
1) Airstrip, Lower	110	grassland and oak woodland	N	N	N	N

2) Airstrip, Upper	102	grassland and oak woodland	N	N	N	N
3) C-10**	339	second growth coniferous forest	Y	Y	Y	N
4) Child's Hill	561	grassland and oak woodland	Y	N	Y	N
5) Copper Creek	148	grassland and oak woodland	N	N	N	N
6) Counts, Upper	118	grassland and oak woodland	N	N	N	N
7) Counts, Lower	220	grassland and oak woodland	Y	Y	Y	N
8) Coyote Creek	1,063	grassland and oak woodland	N	N	N	N
9) Davison**	10	grassland	Y	Y	Y	N
10) DeMartin	5	grassland	N	N	N	N
11) Dolason, Lower	220	grassland and oak woodland	Y	Y	Y	N
12) Dolason, Upper	94	grassland and oak woodland	Y	N	Y	N
13) Dooleyville	111	grassland and oak woodland	Y	Y	Y	N
14) Eastside	107	grassland and oak woodland	N	N	N	N
15) Elk Camp, Lower	244	grassland and oak woodland	Y	Y	Y	N
16) Elk Camp, Upper	37	grassland and oak woodland	Y	N	Y	N
17) Enderts**	109	coastal grass and scrub	N	N	N	Oregon silverspot butterfly and western lily
18) Gans, Lower**	32	grassland and oak woodland	Y	Y	Y	N
19) Gans, Upper	17	grassland and oak woodland	Y	Y	Y	N
20) Holter Ridge Beargrass**	5	second growth coniferous forest	Y (5)	N	Y (5)	N
21) Lagoon Creek**	68	coastal grass and scrub	N	N	N	western lily
22) Little Bald Hills	1,470	grassland and pine woodland	N	N	N	mardon skipper (250)
23) Lyons, Lower	143	grassland and oak woodland	N	N	N	N

24) Lyons, Upper	208	grassland and oak woodland	N	N	N	N
25) Mainstem	166	grassland and oak woodland	Y	N	Y	N
26) Major Creek	7	coastal grass and scrub	N	N	N	western lily
27) Maneze	226	grassland and oak woodland	Y	N	Y	N
28) Mid Basin	129	grassland and oak woodland	N	N	N	N
29) Pig Pen	69	grassland and oak woodland	Y	Y	Y	N
30) School House	300	grassland and oak woodland	N	N	N	N
31) South Boundary	86	grassland and oak woodland	Y	N	Y	N
32) Tick	34	grassland and oak woodland	Y	Y	Y	N
33) Upper K&K**	40	second growth coniferous forest	Y (40)	N	Y (40)	N
34) Wildcat**	1,054	second growth coniferous forest	Y (1,054)	Y	Y (1,054)	N
35) Williams Ridge	118	grassland and oak woodland	N	N	N	N
36) Wooden Gate	243	grassland and oak woodland	N	N	N	N
Approximate Acres To Be Burned Within Suitable Habitat			1,099	0	1,099	OS Butterfly = 109 Western Lily = 191 Mardon Skipper = 250

** Indicates unit only in proposed action (Alternative 1, 2010 FMP); other units are all included in Alternative 2 (no action, 2005 FMP).

The Pig Pen prescribed burn unit is located within 150 feet of Redwood Creek. Previous prescribed burns within this unit have been very spotty with much of the unit not burned due to the high fuel moisture and shading from the surrounding old growth redwood forest. The potential for ash transportation into Redwood Creek is very low because the Pig Pen unit is small, composed entirely of grass and small shrubs with little biomass to burn and that regrows within the first few weeks after initial rains, and separated from Redwood Creek by a 50-foot-wide strip of riparian shrubs and red alders that would intercept ash and sediment.

Copper Creek runs through the middle of the Wildcat unit in second growth coniferous forest. A low-intensity burn prescription is intended to consume small-diameter woody ground fuels, pole-sized

trees, herbaceous vegetation, and duff. Riparian shading would not be altered by an understory burn that does not reduce forest canopy. The amount of ash sediment mobilized by rain that falls onto burned areas would be minimized by intact forest canopy; large woody debris remaining after a low-intensity burn; and spotty burn pattern due to high moisture content of fuels and unburned riparian areas. A stream quality monitoring program would be used to assess the effects of the prescribed burn on water quality.

The potential for mobilization of ash and sediment into either Redwood Creek or Copper Creek following prescribed burns in the Pig Pen and Wildcat units is low. If the first rainstorm has sufficient power to mobilize ash and sediment from the burned area, it would likely result in a volume of water in the creek large enough to rapidly dilute any ash sediment that does reach the creek. Any adverse effects including turbidity, gill irritation and possibly a slight change in water acidity would be very localized and would rapidly dissipate over a matter of days if not hours. The adverse indirect effects on listed fish from prescribed burns in the Pig Pen and Wildcat units would be short-term and negligible to minor. Rainstorms of sufficient intensity to increase stream flows in Redwood Creek would cause greater decreases in water quality from road-related erosion than from sedimentation related to prescribed fire.

Terrestrial Vertebrates—Tables 3 and 4 show the acreages of habitat for northern spotted owls, marbled murrelets, and Pacific fishers that would be affected by prescribed fire and by construction or maintenance of shaded fuel breaks. The acreages in Table 3 are for the proposed action (Alternative 1, 2010 FMP). Under Alternative 2 (no action, 2005 FMP), fewer acres are affected in fewer prescribed fire units (4,600 acres in 28 units compared to 6,800 acres in 36 units in the proposed action under the 2010 FMP) and one less shaded fuel break (416 acres in four fuel breaks under Alternative 2 compared to 468 acres in five breaks under the proposed action.)

Table 4—Sensitive Species Habitat Affected by Shaded Fuel Breaks

Shaded Fuel Break Name	Total Acres To Be Treated	Adjacent to or within 0.25 miles of suitable candidate, threatened or endangered species habitat? (acres suitable habitat to be treated)		
		Northern Spotted Owl	Marbled Murrelet	Pacific Fisher
Holter Ridge Road/ B Line Road	368	Yes (Y, 368)	Y (3)	Y (368)
Bald Hills Road	75	Y (75)	Y	Y (75)
Wolf Creek Housing/Fire Cache Complex	15	Y	Y	Y
Hiouchi Park Housing/Fire Cache	15	No	No	No

Howland Hills Outdoor School/ Access Road **	25	Y (25)	Y	Y (25)
Approximate total acres to be treated within suitable habitat		468	3	468

Northern Spotted Owls—Under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP), northern spotted owls may be affected but not adversely affected by planned fire management actions. Effects on northern spotted owls under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would be similar. There are differences between the two alternatives related to differences in the total acreage treated either with prescribed fire or for construction and maintenance of shaded fuel breaks.

All activities as well as prescribed burning within, adjacent to or within either 500 feet or 0.25 miles (depending on the noise intensity of activity) of suitable spotted owl habitat would occur outside of the restriction periods or would require surveys to determine whether owls are present.

Three prescribed burn units (Holter Ridge Beargrass, Upper K&K, Wildcat) and four shaded fuel breaks (Holter Ridge Road/B Line Road, Bald Hills Road, Wolf Creek Housing/Fire Cache Complex, Howland Hills Outdoor School Road and Complex) are located either wholly or partially in suitable spotted owl nesting, roosting, and foraging habitat. A portion of the Holter Ridge/B-Line shaded fuel break and Airstrip Lower burn unit are within the home ranges of known spotted owl territories. Neither of the units is within the core area (0.25 mile radius around an activity center) but both are within 1.3-mile home range of the activity centers. All the other units are outside the home range of any known owl territories. The same restriction periods and survey requirements apply to preparation work for these prescribed fire units and shaded fuel breaks.

The quality of habitat would be temporarily degraded by preparation and prescribed burns but still suitable over the short term and would be improved over the long term. In the shaded fuel breaks and the burn units, habitat would be slightly degraded by removal of trees less than 18 inches dbh for preparation activities. The prescribed broadcast burns are expected to degrade the suitability of the stands temporarily by reducing some potential prey food sources and prey den/resting/cover habitat. Greater overall light penetration and nutrient release caused by a moderate to low intensity burn would improve prey habitat in the long term. Over the longer term, mechanical thinning and low intensity burns would improve quality of habitat by increasing the growth rate of trees. New cavities would be created by killing some trees or existing cavities would be enlarged in logs and snags, improving prey habitat and potentially creating suitable owl nesting habitat. Lower tree densities would improve flyways for owls in many of these densely stocked, regenerating stands. Greater numbers of larger trees would improve suitable owl nesting and roosting habitat.

Smoke from broadcast burns is not anticipated to cause direct harm to northern spotted owls that were not present when surveys were done but that might be present when burns are ignited. The prescribed burning operations would create smoke and noise that would flush any resident owls out of the

treatment area. The relatively slow ignition rate should provide ample time for mobile owls to move out of harms way.

Prescribed burns have the potential for indirect effects to spotted owls from smoke generated during prescribed burns drifting into occupied habitat and causing individual owls or owl prey to be temporarily irritated or exposed to potentially damaging smoke related effects. This would be most critical to owlets which would not be able to move out of the affected area. Seventeen of the burn units (Airstrip Upper, Airstrip Lower, Counts Upper, Copper Creek, Coyote Creek, DeMartin, Eastside, Enderts, Lagoon Creek, Little Bald Hills, Lyons Lower, Lyons Upper, Major Creek, Mid Basin, Schoolhouse, Williams Ridge, Wooden Gate) are greater than 0.25 mile from suitable habitat and would most likely not be burned until mid-July or later when conditions are dry enough to allow proper ignition. The majority of owlets within RNSP have fledged by that time and should be able to move out of areas of smoke. All of these prescribed burns units are located upslope of suitable habitat areas and are grasslands that produce short intervals of smoke. Burn prescriptions require low winds before ignition is allowed so smoke columns would quickly rise well above the tree canopy and disperse before reaching suitable habitat areas. Only small amounts of woody debris along unit edges are expected to be burned that could smolder for longer periods.

The other burn units are located in, near or predominantly upwind of suitable spotted owl habitat. These units would not be burned until after September 15, by which time all owlets should be fledged and able to easily move out of smoky areas. Smoke is expected to disperse quickly in these units. Smoke effects on owls and owlets would be negligible from prescribed fires in these units.

Some prescribed fires and preparation for these fires and construction or maintenance of shaded fuel breaks under both the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) may degrade approximately 969 acres of suitable spotted owl foraging habitat and 431 acres of suitable nesting, roosting and foraging habitat. The habitat areas that would be degraded would be dispersed across the landscape with large areas of unaltered habitat around and between the treated areas. The habitat degradation would be temporary and would not render the areas unsuitable because only non-essential habitat components would be altered. Canopy cover would remain at or above the suitability threshold, and all live trees above 18 inches dbh and almost all logs and large snags would remain after treatment. In the moderate to long term, spotted owl habitat would be improved because mechanical thinning or under-burning would improve owl flight paths in stands that are currently densely stocked; improve forest floor productivity by allowing more light penetration and thus possibly increase prey productivity; and would create or enlarge cavities in snags and logs which may provide more prey denning and resting habitat. Additionally, the thinning treatments would accelerate the restoration of late seral stage forest conditions more quickly than if left untreated, which should improve spotted owl habitat quality at a faster rate than in untreated second growth forest stands.

Marbled Murrelet—There would be no effects on marbled murrelets from noise or disturbance under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP). Activities that cause above-ambient noise, visual disturbance, or create smoke within a quarter mile of murrelet habitat would occur outside the restriction period (March 24-September 15).

There would be negligible effects on marbled murrelets from habitat alteration under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP). No suitable nest trees or upper canopy cover trees would be affected under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP). Most of the shaded fuel breaks are located within second growth stands, which currently contain no trees that provide suitable marbled murrelet nest platforms. Approximately 30 residual old growth trees representing approximately 3 acres of suitable nesting habitat within or immediately adjacent to the Holter Ridge/B Line shaded fuel break would be retained. There would be no adverse effects on murrelets from creating or maintaining this shaded fuel break because only trees less than 18 inches dbh would be removed.

All of the prairie, oak woodland, coastal scrub and Little Bald Hills burn units are outside of suitable marbled murrelet habitat. Prescribed burns conducted immediately adjacent to suitable marbled murrelet habitat (Counts Lower, Dolason, Elk Camp Lower, Gans, Pig Pen) would have sufficient fire fighting personnel, holding lines, contingency personnel, and equipment present to prevent an escape into suitable murrelet habitat.

There would be no indirect adverse effects on marbled murrelets from smoke generated during prescribed burns. Seventeen of the burn units (Airstrip Upper, Airstrip Lower, Counts Upper, Copper Creek, Coyote Creek, DeMartin, Eastside, Enderts, Lagoon Creek, Little Bald Hills, Lyons Lower, Lyons Upper, Major Creek, Mid Basin, Schoolhouse, Williams Ridge and Wooden Gate) are located upslope of and more than a quarter mile from suitable habitat, and are in grasslands which produce a very short smoke interval. Burn prescriptions require low winds before ignition and smoke columns are anticipated to quickly rise well above the tree canopy and disperse before reaching suitable habitat areas. The other prescribed burn units are located near or upwind of suitable habitat would not be burned until after September 15. All nestlings should be fledged by that date and would not be affected by smoke.

Pacific Fisher—Effects on fishers from fire management activities under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would be negligible.

Activities that produce above-ambient noise and prescribed burning within, adjacent to or within a quarter mile of suitable fisher habitat would be limited to periods of time outside of the natal den noise restriction period (March 1–June 15). Some activities may disturb females and kits in maternal dens but would not disturb females and kits in natal dens. This effect is not considered to be adverse because both kits and adult females are much more mobile once they have left natal dens and thus much less sensitive to disturbance (NPS 2004a).

Five prescribed burn units (Counts Lower, Holter Ridge Beargrass, Mainstem, Upper K&K, Wildcat) are located either wholly or partially in suitable fisher habitat. Four of the shaded fuel breaks (Holter Ridge Road/B Line Road, Bald Hills Road, Wolf Creek Access Road and Complex, Howland Hills Outdoor School Road and Complex) are located either wholly or partially in suitable fisher habitat.

Prescribed burning in the Counts Lower, Holter Ridge Beargrass, Mainstem, Upper K&K, and Wildcat units would not occur during the natal and maternal den period (March 1-July 31) when female fishers and their kits would be the least mobile and thus most susceptible to fire or smoke injury or an increased threat of predation due to forced movement. All of these units would be burned after September 15, when all age classes of fishers are highly mobile. Most healthy fishers would move out of prescribed burn units because of disturbance caused by both the fire and the fire crews. All of the prescribed burn units are lit from the tops of slopes downwards, creating a very slow rate of fire spread downhill, giving fishers ample time to move to safe areas.

Prescribed burns would have minor short-term adverse effects and long-term beneficial effects on fishers from habitat alteration. Prescribed burns may consume some saplings and pole-sized trees, burn some logs and snags, and kill a small number of overstory trees if present within a unit. Prescribed fire would temporarily decrease habitat suitability by consuming some potential fisher prey food sources (small herbaceous vegetation and shrubs) and perhaps some potential prey den/resting/cover habitat (stick piles, small logs, duff layers). Greater overall light penetration and nutrient release caused by the moderate to low intensity burn would produce more young, nutritious herbaceous vegetation and shrub growth which in turn could positively influence prey populations in the longer term. New snags created by killing overstory trees would improve fisher habitat over the long-term. Large tree recruitment would increase and new cavities would be created or existing cavities in logs and snags enlarged, improving prey habitat and potentially creating suitable fisher denning habitat.

Indirect effects on fishers from smoke generated during prescribed burns drifting into occupied habitat are expected to be negligible. Seventeen of the burn units (Airstrip Upper, Airstrip Lower, Counts Upper, Copper Creek, Coyote Creek, DeMartin, Eastside, Enderts, Lagoon Creek, Little Bald Hills, Lyons Lower, Lyons Upper, Major Creek, Mid Basin, Schoolhouse, Williams Ridge, Wooden Gate) are more than a quarter mile from suitable habitat and may be burned during the breeding season. These areas would most likely be burned after July 15 when conditions are typically dry enough to allow proper ignition. Kits would be out of the natal den and possibly out of maternal dens by then (Raley 2002) and thus able to move out of the affected area more easily. All of these burn units are in grasslands located upslope of suitable habitat areas. Burn prescriptions require low winds before ignition is allowed, so smoke columns should quickly rise well above the tree canopy and disperse before reaching suitable habitat areas. Burns in grasslands produce a very short interval of smoke which would greatly lessen the potential impact. Wind shifts could move smoke into habitat areas but the smoke would disperse quickly.

Construction and maintenance of the Holter Ridge/B Line Road, Bald Hills Road, Wolf Creek Access Road and Complex and Howland Hill Outdoor School Access Road and Complex shaded fuel breaks within suitable fisher habitat would not adversely affect fishers. Fishers in the area would be able to move quickly out of the 100-foot-wide fuel breaks. Work on these fuel breaks would take place outside the fisher restriction periods.

There would be minor localized adverse effects on fishers from habitat degradation from mechanical fuel reduction in preparation for prescribed fire and for construction of shaded fuel breaks.

Prescriptions for mechanical fuel reduction in preparation for prescribed fire and for construction of shaded fuel breaks are the same. In the burn units, only areas within 50 feet of hand lines or in areas of heavy oak woodland or grassland encroachment would be mechanically treated. Only subdominant trees less than 18 inches dbh would be removed. These trees do not provide suitable denning or resting habitat. Canopy cover would not be lowered below 60%; sufficient cover would remain to maintain the stands as suitable fisher habitat. Over the long term, fisher habitat would be improved by mechanical fuel reduction treatments that remove small trees. Mechanical thinning would reduce competition within the stands and result in faster tree growth. Greater numbers of larger trees would produce larger numbers of suitable denning and resting trees. Prey habitat is also expected to improve.

Cumulative Effects on Sensitive, Threatened, and Endangered Species

Cumulative effects on threatened and endangered species in the national park include those from actions in the state parks in RNSP, on adjacent lands managed by the US Forest Service or other agencies, and on adjacent private lands that have the potential to impact listed species in the national park.

Outside the parks, the primary activities that affect threatened and endangered species known to occupy the parks are loss of forest habitat from logging, residential, and industrial development; dams for power development, flood control, and water supply for domestic and agricultural activities; and residential, commercial, industrial, and recreational development projects that reduce the quality of habitat or decrease the quantity of habitat. For anadromous fish, recreational and commercial fishing also affect fish populations over both the short and long term. These activities have occurred over a large geographic region for many years. In most cases, these activities took place prior to current environmental laws and regulations.

Most private timber company land immediately adjacent to park boundaries is slated for future timber harvest, including some post-harvest prescribed burning in preparation for reforestation. Timber harvest and prescribed burning has occurred, and will occur in the future, in stands adjacent to the park. However, this activity has been and most likely will continue to be outside the breeding seasons of the spotted owl, marbled murrelet and fisher if the activity would occur within the park's Special Treatment Areas, under the current California Forest Practice Act regulations. Additionally, the local North Coast Unified Air Quality Management District controls the timing of prescribed burns to reduce the amount of smoke generated in any one location.

Timber harvest on Green Diamond Resource Company lands adjacent to the parks is conducted under the requirements of Habitat Conservation Plans approved by the US Fish and Wildlife Service or NOAA Fisheries and designed to provide long-term stability for salmonid and northern spotted owl populations. Thinning prescriptions in the surrounding private timber lands are likely to remove more trees and open up the canopy more than under park proposals for fire management, watershed restoration, and management of second growth forests. The thinning will most likely cause some temporary habitat degradation to some listed salmonid habitat. The use of riparian management zones as stipulated in the California Forest Practice Rules and habitat conservation plans should provide some significant protection of streamside areas. The thinning is likely to temporarily degrade

some suitable spotted owl and fisher habitat but will most likely result in a more rapid improvement in habitat quality in the long term until the stands are harvested under a clear cut prescription.

Since the 2005 FMP (Alternative 2, no action) was approved, spotted owl numbers in the park have declined, with barred owls occupying territories formerly occupied by spotted owls. There is currently no active management of barred owls taking place on either park land or private timber lands bordering the parks.

It is unknown how much additional mardon skipper suitable habitat is located on adjacent Six Rivers National Forest property in the Little Bald Hills, but no additional prescribed burning is planned for the immediate future in that area.

Prescribed fire is proposed during the next five years in two old growth forest units on state park lands within RNSP, Boyes Prairie in Prairie Creek Redwoods State Park and Peterson Memorial Trail in Jedediah Smith Redwoods, and in the grassland at Boyes Prairie. The burn units are more than 300 feet from any perennial stream and there are no intermittent streams within 100 feet of either unit. Because units are located on flat ground, there is no possibility for ash sediment transport to any stream. Therefore, there would be no effects on listed salmonids from burning in these units.

The state park old growth prescribed fire units contain suitable habitat for northern spotted owls, marbled murrelets, and Pacific fishers. The Boyes Prairie old growth burn unit is 30 acres of old growth redwood dominated forest fronting the edge of the eastern side of the Boyes Prairie grassland unit in Prairie Creek Redwoods State Park. The Peterson Memorial Trail old growth burn unit is 3 acres of flat, bottomland redwood dominated forest in Jedediah Smith Redwoods State Park. Northern spotted owl surveys conducted for the Boyes Prairie old growth burn unit indicate that the area is occupied by breeding barred owls; spotted owls are therefore unlikely to be affected by this burn. Approximately 33 acres of old growth nesting habitat would be degraded as a result of the two proposed prescribed burns. Fewer than six large Sitka spruce trees with a height of one-half the site potential tree height are expected to be killed in the Peterson burn. Lower canopy trees and shrubs would be killed by the prescribed fires; mid and upper canopy structure would not be altered. Large logs may be partially burned, creating new cavities. Nesting and roosting habitat would be unaltered. Foraging and prey habitat may be temporarily degraded over the short term but should improve over the medium and long term. The two old growth burns would have a negligible short-term effect on habitat suitability and quality and a minor long-term benefit.

Conclusions (Effects on Sensitive, Threatened, and Endangered Species)

The proposed action (Alternative 1, 2010 FMP) may affect and is likely to adversely affect California coastal Chinook salmon, northern California steelhead trout, and/or southern Oregon/northern California coastal coho salmon and their designated critical habitat due to minor amounts of short-term sedimentation from ash from prescribed burning of the Wildcat and Pig Pen burn units (NPS 2009c). An unknown and unquantifiable but presumably small number of individual fish would be affected. The effect would be localized, temporary, and minor.

The no action alternative (Alternative 2, 2005 FMP) may affect but is not likely to adversely affect California coastal Chinook salmon, northern California steelhead trout or southern Oregon/northern California coastal coho salmon and their critical habitat (NPS 2004c).

None of the activities under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) are expected to adversely affect spotted owls or marbled murrelets due to noise or visual disturbance because no prescribed burning or mechanical treatments would occur between February 1 and September 15 in unsurveyed or occupied habitat.

Some prescribed fires and preparation for these fires and construction or maintenance of shaded fuel breaks under both the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) may degrade approximately 969 acres of suitable spotted owl foraging habitat and 431 acres of suitable nesting, roosting, and foraging suitable spotted owl habitat. The degradation is temporary and minor. There would be a minor long-term benefit to spotted owl habitat from removal of small trees that would promote faster growth of larger trees.

The NPS determined, and the USFWS concurred, that the proposed action (Alternative 1, 2010 FMP) would not affect the Oregon silverspot butterfly.

The NPS determined, and the USFWS concurred, that the proposed action (Alternative 1, 2010 FMP) may affect but is not likely to adversely affect marbled murrelets or their designated critical habitat, northern spotted owls, or western lilies. Adverse effects on these species are indirect effects from changes to habitat from prescribed fire and preparations for prescribed fire. Short-term adverse effects on habitat from removal of brush and small trees and consumption of vegetation by fire would be localized and minor. Long-term effects are related to habitat improvement and would be localized, beneficial, and minor.

The NPS determined, and the USFWS concurred, that Alternative 2 (2005 FMP, no action) would not affect the Oregon silverspot butterfly, bald eagle, or critical habitat for the marbled murrelet (NPS 2004c).

EFFECTS ON CULTURAL RESOURCES

Impacts to cultural resources include direct impacts from the fire itself or from fire operations including wildfire suppression activities or indirect impacts from fire operations including suppression actions. The following section is derived from Allen and Praetzellis (2009).

The locations of some cultural resources are known precisely, e.g. historic structures in the Bald Hills. Some resources that have not been documented might be present in areas where prescribed fires are planned or where wildfires break out, e.g. archeological sites that have become overgrown by vegetation or in areas that have never been surveyed. Potential impacts on cultural resources that are described here are more likely to result from a wildfire and subsequent suppression actions, rather than from prescribed fires that are planned for a specific area where cultural resources can be located prior to ignition and protected.

The impact analyses for effects on cultural resources in Redwood National Park under or Alternative 3 (suppression only) are presented as general impacts that would be most likely to occur in the event of a wildfire. Planned actions under either the 2010 FMP (the proposed action, Alternative 1) or the no action alternative (2005 FMP, Alternative 2) include measures to avoid or minimize any adverse effects on known cultural resources.

Direct Effects on Cultural Resources from Fire

Fire can directly affect historic properties by damaging or altering elements or attributes of cultural materials that make them significant. Direct damage from fire can be the result of burning, heat, or smoke. Fire intensity and burn severity vary with fuel type and fuel loading and is generally greater under conditions with heavier fuels and fuel loads. While fire intensity and burn severity generally increase with heavier fuel loads, fuel arrangement plays a significant role in fire behavior as the presence or absence of ladder and intermediary fuels will allow or prevent fire from entering the tree crowns or igniting large heavy fuels such as down logs. Surface fires are usually associated with prescribed burns, whereas crown fires occur primarily during wildfires. Ground fires with high burn severity can even damage subsurface cultural materials.

Fuel models and fire behavior play an important role in the effect of fire on cultural materials. The size, quantity, and arrangement of flammable materials often dictate fire intensity and burn severity. General grouping for fuel models with similar fire behavior include grass and grass-dominated, chaparral and shrub fields, timber litter, and slash.

Grass and grass-dominated prairies occur in the Bald Hills, Coastal FMU, and Little Bald Hills. The Coastal FMU also includes chaparral and shrub fields. The Coniferous Forest FMU includes timber litter (timber, closed timber litter, and hardwood litter) and slash.

Archeological Resources—Archeological sites consist of intact features, artifact assemblages, and other material remains that are generally significant because of their information potential to address past human lifeways. Prehistoric archeological resources include but are not limited to sparse flaked stone artifact scatters, habitation sites containing coastal midden deposits of shellfish and dark organic soil, and features such as hearths and house pits. Artifacts and assemblages of artifacts may be damaged or destroyed by fire, or the physical characteristics of the materials that have information potential may be altered. Flaked-stone and/or ground-stone artifacts are common at archeological sites in the park that have a prehistoric component. Examples of fire effects on these lithic materials include spalling of ground-stone artifacts and fracturing of flaked stone artifacts. Bone may be chemically altered and calcified. It can also become more brittle and fragile (Bennett and Kunzman 1985).

Artifacts made of obsidian are particularly susceptible to the effects of fire. Research shows that hydration rinds- the characteristic of obsidian by which it can be dated- are damaged by temperatures exceeding 500° F (Bennett and Kunzman 1985) and possibly affected at temperatures as low as 150° F if exposed for an extended period of time (Deal 2001).

Historic-period archeological sites in the park often include wooden features, objects, and debris that will burn under most fire conditions, while other types of artifacts such as those of glass, metal, and ceramics are generally only damaged in fires of a fairly high intensity or duration (Haecker 2001). Duration of heating and how that affects archeological artifacts is not well understood, but in general, the longer an artifact is exposed to heat, the greater the likelihood of damage. Fire can completely consume artifacts and features, or alter artifact and feature attributes impacting information potential (e.g., burning off organic residues, cracking or melting glass, oxidizing metal, etc.).

Historic Structures—Historic-period buildings and structures in the park, with the exception of roads and trails, generally include a wooden component or else the entire structure itself is made of wood that will burn under most fire conditions. Depending on field conditions, fuels adjacent to historic-period structures can ignite historic fabric depending on fuel moisture of the cultural materials, and fire intensity and duration of the fire. Fuels around structures can be moved away from the historic fabric to prevent ignition, but with sufficient fire intensity and duration cultural fabric may also be ignited by radiant heat released by the fire or by embers carried to the structure by convection. Other historic structural fabrics in the park include cinder block and cement. The integrity of these materials can also be compromised by fire.

Cultural Landscapes—Vegetation is an important component of landscapes with open grasslands used prehistorically to manage for subsistence, medicine, and materials. While, historic landscapes are representative of grazing areas, orchards, and planted vegetation around habitation areas. The openness of the prairies in the Bald Hills is important both for the prehistoric and the historic landscape. Vegetation composition can be altered beneficially on a large scale with fire resulting in maintaining and even partially restoring the historic extent of grasslands.

Trees and other vegetation planted in habitation areas such as orchards can be damaged or killed by fire. However, in cultural landscapes with a vegetation component, fire can be applied to replicate and maintain historic scenes. Fence lines with wooden fence posts are small-scale cultural landscape features that are also affected by the presence or absence of intermediary fuels. Since prairie grass burns rapidly with a short residence time, the intensity and duration of these types of fire are generally not sufficient to ignite the wooden posts and therefore effects are typically not adverse.

Ethnographic Resources—Materials used traditionally for food, basketry production, and other purposes by American Indians are prevalent throughout the park. Traditionally-used plant species can be impacted by fire at the level of individual plants, and in large extreme fire events the distribution of these plant resources can be impacted across a landscape. Fire can be beneficial in some instances as some plant species important for basket making benefit from the proper application of fire (Anderson 1993).

Large redwood trees are important to the local American Indian community as a life-sustaining material. Redwood trees traditionally provided planks for houses, wood for canoes, stakes for smoking fish, and many other purposes. Sometimes redwood trees have hollowed bases called “goose pens” that are created over a long period of time by many fire events. These hollowed out goose pens have value to American Indians. These goose pens are generally not impacted by low intensity fire,

but can be destroyed in a catastrophic fire event. Also, archeological sites are important to American Indians and are considered to be ethnographic resources. Some locations even have spiritual significance and were or are still used for ceremonial purposes. The visual and noise, and smoke impacts on a particular setting from fire events and related fire management activities, including the presence of numerous fire personnel, can detract from ceremonial activities depending on location and timing.

Summary of Potential Direct Effects from Fire to Historic Properties

Table 5 summarizes the potential impacts to historic properties or types of historic properties known to exist in the park that would result from fire. Definitions of negligible, minor, moderate, or major appear below the table.

Table 5—Potential Direct Effects to Historic Properties by Vegetation Type

Cultural Material	Grass and Grass-dominated	Chaparral and Shrub Fields	Timber Litter	Slash
Archeological Resources				
Obsidian	Minor	Moderate	Moderate	Moderate-Major
Other Lithic Materials	Negligible	Moderate	Minor	Moderate-Major
Midden Soil	Negligible	Moderate	Minor-Moderate	Moderate-Major
Carbon & Soil Samples	Minor	Moderate	Minor-Moderate	Moderate-Major
Bone/Antler	Minor-Moderate	Moderate	Minor-Moderate	Moderate-Major
Historical Trash – Cans, Bottles, Etc.	Negligible	Moderate	Minor-Major	Moderate-Major
Historic Structures				
Buildings	Moderate-Major	Moderate-Major	Moderate-Major	Moderate-Major
Pipeline Stream Crossing (Suspension Bridge)	N/A	N/A	Negligible-Major	N/A
Lyons Gravestone	N/A	N/A	Negligible-Moderate	N/A
Concrete Water Tanks	N/A	N/A	Negligible	N/A
Cultural Landscape				
Wooden Fences & Utility Poles	Minor	Moderate-Major	Moderate-Major	Moderate-Major
Orchards & Fruit Trees	Minor-Moderate	Moderate-Major	Moderate-Major	Moderate-Major
Cement Cisterns & Water Troughs	Negligible	Minor	Minor-Moderate	Moderate
Earthen Embankments & Stock Ponds	Negligible	Minor	Minor-Moderate	Minor-Moderate
Ethnographic Resources				
Vegetation (basket materials, food and medicine)	Minor	Moderate	Minor-Moderate	Moderate
Goose Pens (Hollow Trees)	Negligible	Minor-Moderate	Minor-Major	Minor-Major
Ceremonial/Spiritual Sites	Negligible-Major	Negligible-	Negligible-	Negligible-

		Major	Major	Major
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- Negligible – project activities will have no effect on historic properties.
- Minor – project activities will have no adverse effect on historic properties.
- Moderate – potential for adverse effects to historic properties that can be negated or minimized through site avoidance, fire exclusion, fuel load reduction, or other protection measures.
- Major – adverse effects to historic property identified that cannot be minimized or negated; mitigation must be documented in an official Memorandum of Agreement with SHPO as per 36 CFR 800. 6.

General Impacts to Historic Properties from Fire Operations

Impacts to historic properties can occur during wildfire suppression and control, preparing for and conducting prescribed burns, or mechanical thinning. Fire management activities that occur during wildfire suppression that may adversely affect historic properties include staging of equipment and personnel, construction of fire control lines by hand or with heavy equipment, vegetation-thinning, water drops and use of fire retardants, burning out from control lines or setting backfires, and post-burn mop-up and rehabilitation. Impacts that can occur from prescribed burns include equipment and personnel staging, construction of fire control lines by hand, vegetation thinning, burning out from control lines and igniting the interior of units, and post-burn mop-up and rehabilitation. Mechanical thinning involves vegetation thinning and pile burning which results in high fire intensity and burn severity in very small isolated locations. The following sections are adapted from Siefkin (2001).

Staging and Access—Staging for the management of wildfire and prescribed fires involves distributing vehicles, equipment, and personnel before, during, and after a fire event. During a prescribed fire event, the numbers of personnel and equipment is fairly low compared to wildfires. Staging for the prescribed fire units located close to developed areas is often located in previously developed areas such as roads, pullouts, and parking lots. Vehicles are parked in these locations and equipment is readied. Ground disturbances occur in these areas but is usually very shallow. All terrain vehicles, equipment and personnel are employed on previously constructed fire lines to access the burn unit. In the more remote locations of the burn unit, trails are often used to access the interior of the unit.

Staging for wildfire conditions is frequently more complex and urgent, and includes more equipment and people. While in most cases equipment is driven and parked in designated/and or previously disturbed areas, the increased quantity of equipment and personnel may adversely affect cultural resources. Large temporary base camps are often used to house fire personnel. They are usually located some distance from the fire in parking lots or campgrounds. Spike camps might be established for field personnel in the event of a large wildfire. Spike camps are established on the margins of the burn and, on larger fires, may house hundreds. Ground disturbing activities at these camps would include increased foot traffic and excavation of latrines as well as pits for gray water disposal. Heli-spots or drops zones are constructed as needed. Safety zones are established along the perimeter of the burn if vegetation free zones do not exist. This is done to protect fire personnel in the event of extreme fire behavior. Safety zones can be hundreds of square meters in size and are cleared of all standing and ground fuels with hand tools.

Fire Lines—Fire lines are breaks in fuel continuity. Six common fuel breaks might be used for wildfire suppression: handlines, scratch lines, catlines, wetlines, retardant lines, and foam lines. For prescribed fire in the park, lines are generally handlines, scratch lines, or wetlines. Handlines are fire

breaks constructed using shovels, hoes, saws, and chainsaws. Scratch lines are used for a quick fire break in an initial attack and later improved to aid in the fire containment. Catline fire breaks are constructed with tracked vehicles such as bulldozers. Catlines can cause substantial ground disturbance and have a high potential for adverse effect to cultural resources. For example, a catline constructed by CAL FIRE for a firebreak in the July 2008 Motion Fire near the Whiskeytown National Recreation Area went through an unrecorded prehistoric archaeological site. In his site assessment, Allen (2009) reports that an estimated 131 square meters (approximately 55%) of the site's top 10cm surface had been disturbed. Wetlines are constructed by laying down a strip of water on fine fuel. Retardant lines are constructed with chemical fire retardants. Foam lines are generally comprised of chemically fire retardant foams.

Fire line construction is far less systematic during the management of wildfires than prescribed fires. The fire lines are often used to contain a direct control (containing the fire to extinguishment) or an indirect control, which secures a boundary or perimeter around the fire. The advantage of a direct control fire is minimization of the fire's size; however, fire line placement could inadvertently affect cultural resources. Indirect control of the fire allows for a better control over where the fire line is placed; however, the fire will burn over a larger area, potentially affecting more cultural resources.

Ignition Techniques—Various ignition patterns are employed when conducting prescribed burns and to suppress wildfires. These techniques have varying implications for cultural resources depending on temperature and intensity. Heading fires are those set to burn upslope or with the wind. In general, these fires tend to burn at high intensity with high spotting potential. Backing fires are usually employed along a fire line or road and are allowed to burn downslope or against the wind. Backing fires are generally of a lower intensity, have slow spot potential, and spread slowly. Flanking fires provide a means to keep flame heights between the levels of heading and backing fires but require coordination between the many individuals who ignite strips that form a series of widening triangles or chevron patterns. Finally, center or ring fires involve the ignition of a central area, and then surrounded by concentric circles/rings of fire from the central ignition area. This type of ignition source burns at a high intensity level in heavy fuel loads.

Ground and aerial ignition of fuels are commonly used in northern California. Generally, ground ignition is accomplished through the use of fuses, drip torches, flame throwers, and terra-torches. In aerial ignitions, plastic sphere dispensers and heli-torches are used. The plastic spheres are filled with jellied gasoline and, if dropped directly onto a site, could cause higher intensity burning.

Retardant Drops—Fire retardants have been successfully employed to protect cultural resources from the direct effects of fire. Two types of fire retardants are used in both wildfire and prescribed burns: chemical agents and physical agents. Physical agent influence heat and diffusion processes, while the chemical agent affects fuels by modifying the course of combustion.

The operational effects of fire retardants on cultural resources relate directly to the application and composition of those retardants. Backpack pumps, fire hoses, and aircraft are used to apply fire retardants. Retardant drops from higher elevations could have adverse effects on cultural resources by toppling standing structures or affecting the ground by eroding midden or scatterings artifacts.

Looting—Looting from fire crews is a threat to cultural resources during both prescribed fires and wildfires. A major problem for cultural resource managers is the protection of sensitive information being disclosed to fire personnel and the need to know of fire crews what resources they need to protect. Looting from fire crews has been documented (Traylor et. al. (1990:103–104), but in many cases, fire personnel were extremely receptive to educational information concerning the laws and importance of protecting cultural resources.

Noise—Direct effects on cultural resources from fire and fire management activities can affect the feeling of cultural landscapes and historic properties. Noise from helicopters and airplanes flying directly over cultural properties affect directly the natural setting of the property. Other noise pollution can be caused by heavy machinery or chainsaws. It should be noted that consultation with concerned Native Americans should take place prior to prescribed burns on or near traditional cultural properties or other sites which may have a great significance in their ancestral history or religious beliefs.

General Impacts to Archeological Resources from Fire Operations

Construction of fire control lines, post-burn mop-up and rehabilitation displaces soil and might damage or disturb the integrity of cultural materials comprising the archeological assemblage at a given site. This might result in irreversible loss of the information potential of the site and compromise its ability to be eligible for the National Register of Historic Places. The scale of impact can vary from a hand-dug “scratch” line to use of bulldozers that can destroy an entire site. Equipment and crew staging can result in some ground disturbance from vehicles, removal of visible artifacts by fire crews, and possibly introduction of invasive plant species on site that would require resource management treatment in the future. Vegetation thinning usually requires pile burning that can result in an adverse effect if the piles are burned within site perimeters. Ignition strategies during wildfire burnouts and prescribed burn implementation determine fire behavior and resulting fire intensity. Burning out from archeological sites or allowing a creeping fire to back through archeological sites reduces fire intensity on the archeological sites. Water and retardant drops can cause soil displacement or induce erosion at the drop point. Additionally, the potential effect of retardants on the chemical composition of cultural materials is not clearly understood.

General Impacts to Historic Structures from Fire Operations

Vegetation thinning can result in beneficial or adverse effects to historic structures. When ladder and intermediary fuels are removed from near historic structures the potential for high intensity fire or burn severity is reduced and the result is beneficial. However, when vegetation is burned in piles too close to a historic structure radiant heat or embers carried by convection may impact the structure. Removal of vegetation surrounding a structure may also induce erosion that may ultimately impact the structure.

The weight of water or retardant drops can damage the structural integrity of a historic structure if the full weight of the drop lands on the structure. Recent studies indicate retardants can stain historic fabric such as wood and stone (Corbeil 2004). The potential short and long term effects of retardants on chemical composition of various cultural materials is not clearly understood.

General Impacts to Cultural Landscapes from Fire Operations

Planned and unplanned fire events or mechanical fuel treatment all occur on a landscape level. In all instances impacts such as vegetation removal, fire control line construction, and ignition activities impact the landscape. Fire control lines result in visible scars on the landscape and can contribute to erosion. Vegetation removal can be beneficial since the historic scene can be maintained or restored by removing encroaching vegetation. However, care is needed when thinning near historical habitation areas where planted vegetation, such as orchard trees and ornamental plants is part of the cultural landscape and should not be removed. Staging of equipment, fire control line construction have the potential to create disturbance in sensitive areas. Use of retardants may affect cultural features and contributing elements to historic districts.

General Impacts to Ethnographic Resources from Fire Operations

Fire management actions such as fire control line construction, vegetation thinning, ignition activities during prescribed fires and wildfire burnouts, and water or retardant drops can impact plants or trees traditionally used by American Indians. Individual plants or trees can also be impacted by equipment and crew staging, pile burning, and post-burn mop-up and rehabilitation. Many archeological sites are considered to be ethnographic resources and are subject to impacts from fire management operations as described above. Finally, certain locations hold spiritual significance and can be impacted by any fire management activities either directly at the location, visually by impacting the view-shed, or simply by timing of the fire event occurs during a time when the spiritual site is traditionally used. Smoke from a prescribed burn or wildfire can also be disturbing during ceremonial activities or events in nearby areas.

Summary of Potential Operational Impacts from Fire to Historic Properties

Operational impacts of fire management actions on cultural resources would be adverse in most cases. However, the degree of impact depends greatly on the nature of the operation and the cultural resource or resources in question. Adverse operational impacts are of particular concern during and after wildfire events. With proper planning, operations can also be used for beneficial purposes. For example, mechanical thinning can effectively remove hazardous fuels from and in the vicinity of cultural resources, as well as restore, enhance or maintain ethnographic resources and cultural landscapes, in cases where the risk of direct impacts is too high.

Indirect Impacts on Cultural Resources from Fire and Fire Operations

Indirect impacts on cultural resources are sometimes difficult to assess, since the impacts may be delayed and incremental. Therefore, the potential for indirect impacts relates to the context in which a cultural resource is found, the nature of that resource, and the type and extent of the disturbance activity. In most cases, intense fire behavior and major suppression efforts associated with wildland fires would render cultural resources vulnerable to indirect impacts soon after the event. Indirect impacts might not be as pronounced following managed actions such as prescribed burns or mechanical thinning, but can have equally adverse consequences given enough time. The following sections are adapted from Siefkin (2001) unless quoted from a specified source.

Erosion—Fire management activities may affect cultural resources due increased runoff and erosion following a fire. Robichaud et al. (2000) conclude that only 2% of annual rainfall turned into runoff on soil with good hydrological conditions and with ground vegetation of 75% or higher. Under these types of conditions, the vegetation holds the soil in place, reducing erosion. In the severe circumstances attendant on moderate to high intensity fires, ground cover was reduced to less than 10% coverage. This resulted in 70% increase in runoff and a 300% increase in soil erosion. These effects to soils could be increased in the event of rain closely after the fire. In a study from the Chamise Experimental Pastures in northern California, soil movement was found to be significantly greater on burned areas than unburned. The amount of soil movement was directly related to slope (e.g., the greater the slope, the greater the erosion). Similar results were reported in a study near Ukiah, California (Hoyer 1982:24).

Looting and Vandalism—The park receives a great deal of public use. Following a prescribed burn or wildfire, previously inaccessible cultural resources prior may suffer from increased looting and vandalism. Many visitors are unaware that removing artifacts from federal land is against the law. Furthermore, the public may inadvertently damage cultural materials on the exposed surface. Siefkin (1999:3) notes that these effects have not been systematically examined, although the problem undoubtedly varies with the resource and vegetation type as well as the local fire behavior. For example, prescribed fires in forested areas often do not appreciably increase the danger to lithic scatters; whereas historic-era artifact concentrations and architectural features do become far more noticeable.

Tree Fall—Fire may cause tree death or tissue damage resulting in a weakened tree that may later succumb to disease and insect infestations. Tree mortality may affect cultural resources. Trees killed outright during the fire may fall over. In falling, artifacts may be uprooted by the root mass and the site's stratigraphic integrity may be harmed. Artifacts, buildings, and structures may be crushed by falling trees. Fallen trees add to the full load and burn at extreme temperatures in a fire. Shultz (2006) notes that some trees are part of the historic landscape or may be elements of a traditional cultural property. Damage to these trees could compromise the integrity of the site.

Carbon Contamination—The contamination of archaeological sites and features, such as hearths, from non-cultural botanical remains is of concern. Contaminated charcoal samples submitted for C-14 dating will yield incorrect data. The contamination of recent plant remains may lead researchers to false conclusions regarding the paleoenvironment.

Researching carbonized botanical remains from the La Mesa Fire, Ford (1990) notes that the cultural and natural (recent) charcoal samples were easily distinguishable. The cultural charcoal exhibited no textural or color differences but was more friable. The natural charcoal was harder and was often scorched on only one surface. However, Ford's samples collected relatively soon after the area had burned. As time passes, non-cultural charcoal may be harder to distinguish from archaeological. Furthermore, the newer sample may remain in the soil matrix for a longer time because of its hardness. Additional contamination could occur as charcoal is mixed into the site matrix by rodents, erosion, and expansion and contraction of the matrix due to heating and cooling.

Invasive Species—The establishment of non-native species following wildfires can pose a threat to long term native plant recovery. Fire regimes and forest structure have changed dramatically due to 19th and 20th century fire management practices. Fuel loads have been increasing while wildfires have been repressed, resulting in infrequent large and severe wildfires which can be directly correlated to adverse ecological effects. These effects can include increased tree mortality, reduced understory plant cover, and increased mortality of soil seed banks. The resulting incidence of exposed bare soil and low tree canopy creates a high potential for non-native species, increased water runoff, and soil erosion in the post-fire environment (Hunter et al. 2006). Prescribed fires can result in wholesale shifts in vegetation communities, e.g., sagebrush to grassland (Siefkin 1999).

Losing native vegetation is a cause for concern. Native Americans have traditionally collected seeds, acorns, and utilized other plants for basketry and other tools in the parks (NPS 2004c). Some of these locations may qualify as traditional cultural properties. Historically, the annual burning of grassland insured new growth. However, with the influx of invading species comes the potential for native plants to be replaced with non-native. This may result in the decline of traditional collecting practices and negatively affect local Native American culture.

Potential Indirect Impacts to Cultural Resources

Archeological Resources—Indirect impacts occur as a result of fire or operational impacts altering the environment and creating the potential of additional impacts. Two key changes in the environment include removal of vegetation and soil displacement. Soil disturbance if not rehabilitated can channel rain runoff resulting in increased soil erosion that may expose, displace, or destroy archeological features or artifacts. Loss of vegetation may reveal artifacts previously obscured by vegetation and if the site is readily accessible can result in increased collecting of surface artifacts or looting of sites by unscrupulous individuals who dig up archeological sites in search of collectible artifacts. Occasionally, trees become weakened and may pose a threat to archeological sites as a hazard tree.

Historic Structures—Loss of vegetation and soil heating may induce hydrophobicity in soils, resulting in sheet wash that may destabilize soils around structures. Soil disturbance near structures can channel water and possibly erode footings and base supports for structures. Occasionally, trees may also become weakened and pose a threat to historic structures as a hazard tree.

Cultural Landscapes—Sheet wash erosion may also occur as the result of fire if high burn severity results in a slope being denuded of vegetation. Vegetation is often also part of a cultural landscape. Reduced competition for sunlight, water, and nutrients may be beneficial for retained culturally significant vegetation. However, hydrophobicity, soil sterilization, and loss of vegetation may result in sheet-wash erosion and in extreme cases loss of top soil that substantially alters what vegetation can grow.

Ethnographic Resources—Various types of vegetation are used traditionally by American Indians. Impacts that occur on the landscape level also affect vegetation traditionally used by American Indians and all the impacts that occur to cultural landscapes also apply. Archeological resources are also considered to be ethnographic resources and all the impacts to archeological sites also apply.

Museum Objects—Museum objects can also be threatened by fire management actions, both the physical well being of the objects themselves while in a field context, and the ability to properly catalog and process those objects when considering available funding and staffing for this work. Post-burn assessments are generally needed to determine if there is potential for indirect impacts at archeological sites. In some cases rehabilitation may be needed to stabilize erosion at sites or in extreme cases emergency data recovery excavations are warranted. When artifacts are exposed and in danger of unauthorized collection it may be necessary to have a qualified archeologist document and collect the endangered artifacts, and to curate the artifacts in the park museum collections facility.

Cultural Resources Protection Measures

Fire program activities have the potential to adversely affect cultural resources in the parks. Effects from these activities include the direct effect of fire itself, the direct effect of fire program operational activities, and the indirect effects of fire and operational activities on cultural resources. The following guidelines will be followed for all planned fire program undertakings where appropriate. These procedures will ensure compliance with the National Historic Preservation Act of 1966, as amended, and provides for a process to negate, minimize, or mitigate adverse effects of fire and fire program activities on historic properties in a manner consistent with 36 CFR 800 and the 2008 Programmatic Agreement among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. Planned fire management actions under the proposed action (2010 FMP, Alternative 1) or the no action alternative (2005 FMP, Alternative 2) would reduce the long-term potential for a catastrophic wildfire.

Guidelines for Cultural Resource Protection during Operational Actions

- Consult with the affiliated Tribes, cultural resource advisors at the NPS Pacific West Regional Office, and the SHPO/THPO.
- Identify historic properties within the area of potential impact for the undertaking.
- Assess potential for adverse effects to historic properties.
 - Complete hazardous fuel assessments when historic properties are present.
- Develop appropriate management recommendations to mitigate adverse effects to historic properties in consultation with affiliated Tribes, cultural resource advisors at the NPS Regional Office, and the SHPO/THPO. General strategies currently employed for historic property protection include:
 - Planning and implementing prescribed burns to take advantage of environmental conditions that minimize impacts to cultural resources.
 - Avoiding historic properties during fire program operational activities.
 - Excluding fire from historic properties
 - Minimizing the impact of fire through fuel load reduction around historic properties.
 - Conducting preventative maintenance consisting of hazard fuel reduction at or around historic properties.
 - Employing environmentally friendly MIST in the vicinity of historic properties.
- Monitoring archeological sites as defined in the cultural resources fire monitoring section of the Cultural Resources Appendix of the Fire Management Plan.
- Develop appropriate management recommendations to mitigate adverse effects to historic properties (Table 1).

Cultural resources and historic properties within prescribed fire subunits would be protected by removing excess fuel and preparing a defensible space. For large burnable structures such as historic barns, three-to-four-foot-wide handlines would be dug and fine fuels removed for a distance of 40 feet around each structure both in preparation for prescribed fires and for general protection in case of wildfires. Most of the parks historic structures would have additional protection through hazard fuel reduction in the vicinity of the structures (Coyote Creek barn, Coyote Creek cabin, Dolason sheep shed, Elk Camp sheep shed and garage, Long Ridge barn, and several structures around the Lyons Ranch homeplace.) The majority of historic structures are located in the Bald Hills FMU. The environmental consequences of actions proposed for protection of historic structures and other significant cultural resources in the Bald Hills are discussed under that section.

Monitoring—Federal land managing agencies are required to avoid or mitigate adverse effects to historic properties while engaged in any undertaking with the potential to affect historic properties. Currently the NPS Pacific West Region fire program enlists the aid of archeologists and other cultural resource specialists to identify potential adverse effects to historic properties and provide management recommendations to negate or minimize these effects. These recommendations are based on the pre-burn evaluation of historic properties by archeologists and other cultural resource specialists such as historic architects, historic landscape architects, affiliated Tribes or Tribal members, and in some cases familial descendents. Recommendations may include monitoring of historic properties during prescribed or wild fires by a qualified archeologist or other cultural resource specialist and post-burn assessment of historic properties to determine if the management recommendations were successful in protecting the resource.

The effect of fire on various cultural materials is not completely understood. Thus, sound risk management depends on continuous feedback based on examination of current management strategies to mitigate the effect of fire on cultural materials. This requires cultural resources monitoring for prescribed and wildfires. Cultural resource monitoring basically includes four stages.

- Identify what cultural resources are located within a proposed project area.
- Conduct pre-project assessments of cultural resources to determine the probable effects of fire, and direct or indirect impacts from fire program activities on cultural materials. Use this information to develop mitigation measures to protect cultural resources.
- Monitor prescribed fires and wildfires to ensure appropriate mitigation methods are employed and provide in-field recommendations to mitigate unforeseen circumstances such as spot fires.
- Conduct post-burn site assessments of historic properties to determine if cultural materials were adversely affected from preparation for or during a fire event, fuel management project, or if they are threatened by long-term indirect impacts such as erosion. Analyze collected data to determine if modification of current mitigation measures is needed.

Research—Limited research relating the effect of fire on cultural resources and American Indian use of fire has been completed. However, additional research is needed to allow resource managers to make informed decisions regarding the use of fire when cultural resources may be affected, or to replicate pre-contact fire regimes. Fire is a tool that can be used to restore or maintain cultural landscapes.

Specific research topics may include:

- Effect of fire on cultural resources
- Use of fire to restore and maintain cultural landscapes
- American Indian use of fire
 - Guidelines for Cultural Resource Protection during Wildfire Events
- Maintain and make available cultural resource digital databases and GIS layers on CDs or other portable digital format during fire season to expedite the management decision making process.
- Notify immediately the park cultural resources program manager and/or Northern California Sub-cluster fire archeologist in the event of wildfire that requires extended attack.
- Require consultation with an archeologist and/or other cultural resource specialist and notify SHPO/THPO if extended attack is needed and the wildfire is in an archeologically or culturally sensitive area.
- Consult with affiliated tribes when resources of ethnographic significance are threatened by fire or fire suppression activities.
- Ensure that historic structures, cultural landscapes, archeological sites, and resources of ethnographic significance that are determined eligible or listed on the NRHP are prioritized in resource protection planning.
- Consult with the SHPO/THPO, affiliated American Indians and stakeholder, and cultural resource advisors at the NPS Regional Office in the planning and execution of rehabilitation efforts following wildfires.
- Employ environmentally friendly, minimum impact rehabilitation/suppression techniques (MIST) in the vicinity of cultural resources.
- Conduct post-burn inventories and cultural resource condition assessments.

Pre-project Work—As wildfires and emergency fire-suppression efforts generally preclude careful environmental review or cultural resource inventory, a database with containing all known cultural resources within each fire management unit, along with maps, is part of the park guidelines for actions during a wildfire event (see guidelines below). The cultural resource manager’s job at the beginning stage of planning is to come up with a strategy of how to protect and minimize the unacceptable impacts from fire and fire suppression activities. The fire managers use fire behavior predictive models and need to supply the cultural resource manager with an APE.

Identifying and Recording Cultural Resources—A pre-burn survey of the APE is needed if an inventory has not been conducted previously. The survey methods would depend on the location, terrain, and expected resource types but in most cases would involve pedestrian survey. Recording new cultural resources or updates to previously recorded resources should be recorded on appropriate forms and includes sketch maps and GPS information.

The cultural resource manager conducts background research to investigate the kinds of cultural resources known or suspected to occur within a given burn unit(s) (Siefkin 2001:n.p.). These are referred to as resources of interest, and include classes that that may be eligible to NRHP and also may be affected by direct, operational, or indirect fire efforts. In addition to historic properties, there may be other resources in the APE which may not meet the NRHP threshold, but nevertheless have values that may which be compromised by fire or fire management (Siefkin 2001:n.p.). It is important to consult with the local tribal representative and any other concerned Native American

groups to address their concerns have and to help identify traditional cultural properties and ethnographic resources in the APE.

Evaluation and Determination of Effects—The cultural resource manager must prioritize which cultural resources are at risk and what the effects to those resources may be (NPS 2004b). During a wildfire event, temperatures can be extreme and fire severity classes are in the moderate to high range. Given these temperature, most cultural resources will be adversely affect by the fire.

Post-Fire Procedures—The protection and stabilization of cultural resources affected by fire and fire management activities fall under the policies of both short term emergency stabilization using BAER techniques and long term stabilization and rehabilitation under BAR techniques.

Burned Area Emergency Rehabilitation (BAER) Treatments. The comprehensive BAER manual describes recommended treatments (NPS 2006b). The objectives of these treatments is to stabilize and prevent degradation to archeological sites, cultural landscapes, traditional cultural properties, and historic structures until long-term cultural resource management strategies can be developed and implemented. BAER treatments are designed to conform to the NHPA Section 106 process (36 CFR 800). Below is a description of allowable and prohibited actions under the BAER program.

Allowable actions under BAER include:

- Site Stabilization and Protection. Determining whether known historic properties may be further degraded (e.g., through the creation of a site inspection record). Incidental discovery of cultural resource sites should be noted; these may be protected.
- Patrolling, camouflaging, or burying significant heritage sites are appropriate actions when necessary to prevent a critical loss of heritage site value when looting potential is high. Patrolling should be considered only where there are not other effective alternatives.
- NHPA Section 106 Compliance. Emergency stabilization treatments that disturb the soil surface are reviewed for potential effects on significant cultural resources. The appropriate agency cultural resource specialist should become involved in treatment planning as early as possible.
- Treatments evaluated as No Historic Property (no historic properties present), or as actions permitted under existing agency programmatic agreements or memorandum of agreement can be undertaken without further State Historic Preservation Officer or Tribal Historic Preservation Officer consultation. Treatments with no adverse effect can be undertaken after appropriate consultation with SHPO or THPO. Treatments with adverse effect should be addressed by the agency cultural resource coordinator.

Prohibited actions under BAER include

- Systematic inventories or surveys
- Assessments of the cultural resource damage caused by the fire
- Site and data recovery, cataloging, and other programmatic administrative actions
- Heritage site restoration
- Wildfire suppression activity damage repair.

Burned Area Rehabilitation (BAR) Treatments. According to the BAR Guidebook (NPS 2006c), burned area rehabilitation treatments that disturb the soil surface must be reviewed for potential effects on cultural resources. The cultural resource specialist should become involved in treatment planning as early as possible.

Treatments evaluated as No Historic Property (no historic properties present) or as actions permitted under existing agency programmatic agreements or memorandum of agreement can be undertaken without further SHPO or THPO consultation. Treatments with no adverse effect can be undertaken after appropriate consultation with SHPO or THPO. Treatments with adverse effect should be addressed by the agency cultural resource coordinator. BAR funds cannot be used for restoration of any cultural resource or heritage site.

Post Fire Surveys—Jackson (1998) notes that post-fire surveys should be employed in the burned area: to provide inventories of lands previously inaccessible due to dense brush and vegetation; monitor the effectiveness of pre-fire archaeological survey(s); to increase heritage resources inventories for the park, providing more comprehensive management and research information, and to advance compliance with the requirements of Section 110(a)(2).

Protection, Treatment, and Monitoring—During a fire, the cultural resource manager should be in close contact with fire managers to identify the cultural resources at risk. No organization, technology, or equipment can provide absolute protection from the fire. Avoidance is the best protection measure for cultural resources. As discussed above, a variety of protective measures are available to prevent adverse effects on cultural resources. Below are protective measures presented by Jackson (2004).

- **Buffer zones.** Buffer zones can be cleared around cultural resources to lessen the chance of adverse effects from fire or fire management.
- **Firebreaks.** Cultural resources may be protected firebreaks (firelines) that eliminate and break the chain of fuels to the resource. Types of firebreaks include natural firelines, retardant lines, wet lines, handlines, scratch lines, and catlines.
- **Sprinklers.** Sprinklers can be used to prevent the progress of fire.
- **Foam wetting agents (suppressants) and fire retardants.** Foams may be applied to cultural resources and/or around cultural resources to protect them from fire damage.
- **Back burning.** Back burning reduces fuels, which adds a buffer zone between the cultural resource and the fire.
- **Fire fabric or wraps.** Fire resistant fabric may be placed over combustible resources to protect them from heat. Sometimes known as cabin wrap, this metallic material is stapled around the perimeter to form a nonflammable barrier.
- **Burial.** The effects of heat on many archeological resources is far less severe when the resource is buried at least 10cm below the surface. This type of protective measure is commonly used on well-defined features such as rock outcrops where the soil can be relocated without damaging the resource.

Reporting—The park cultural resource staff conducts post-burn site assessments of historic properties to determine if cultural materials were adversely affected by fire event or fuel management project, or if they are threatened by long-term indirect impacts such as erosion. The assessment analyzes data about the event and its effects to determine if mitigation measures should be modified.

A post-burn survey of the burned area is suggested by Jackson (1998:21). A post-fire survey of the APE would be effective for locating previously unrecorded resources and would advance compliance with Section 110(a)(2) of NHPA.

Yosemite National Park creates an annual report that describes the effects on cultural resources. The report includes survey coverage, inventory forms, pre-burn and post-burn condition evaluation forms, a description of protection and treatment measures, and recommendations for future monitoring (NPS 2007). Instituting this kind of report would be an effective way to document the effects of fire at Redwood National Park.

Section 106 NHPA Process Related to Fire Management Activities

The NPS has identified that there is a potential for adverse effects to historic properties as a result of fire management operations directly from fire, directly from operational activities, and indirectly as a result of post fire management actions; however, such adverse effects can be mitigated by taking appropriate steps to inventory, pre-treat, protect, monitor, and report information about historic properties located within the area of potential effect for fire management activities.

The 2008 Programmatic Agreement among the NPS, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation outlines a streamlined process that can be used by NPS to comply with Section 106 NHPA when certain conditions are met; therefore, NPS may use the streamlined process where appropriate for fire management actions at RNSP as outlined in this programmatic agreement.

When the conditions of the 2008 programmatic agreement are not met, the NPS will conduct consultation with the California SHPO/THPO, public, and affiliated Tribes, as required under 36 CFR 800.

The NPS is currently in the process of drafting a separate programmatic agreement that will be specific to fire management actions throughout California and possibly the entire Pacific West Region of the NPS and that will streamline the Section 106 process for such activities. Since the RNSP Fire Management Plan will not expire until 2015, the NPS may adopt any new programmatic that is developed during the lifetime of this plan that would streamline the Section 106 process for fire management activities at Redwood National Park.

Cumulative Effects on Cultural Resources

Cumulative impacts are the combined effect of direct and indirect impacts that can eventually result in an adverse effect to historic properties. Cumulative impacts are difficult to identify and assess given the project- or event-oriented nature of resource management. Direct and indirect impacts are identified at the project or event level, often only with availability of staff with extensive field experience, and appropriate protective or preventative actions are taken to protect identified historic properties. The effectiveness of management actions can only be assessed with post-burn site assessments and monitoring. This is especially important for management units that are mechanically treated or burned in prescription on a regular cycle. Cumulative impacts may not be apparent during

one treatment of a management unit within a cycle. They may only become apparent, after repeated monitoring over a period of many treatments.

Other NPS activities that might affect cultural resources in the park include watershed restoration, management of second growth forests and exotic plants, maintenance and repairs to roads, trails, and other facilities, and development of new facilities. All of these activities are conducted under the same general guidelines for identifying and protecting cultural resources so that long-term adverse effects are avoided to the greatest extent practicable.

Conclusions (Effects on Cultural Resources)

Planned actions that have the potential to affect cultural resources include prescribed fire, and any ground disturbing activities associated with preparation, suppression, and staging of fire management actions. These planned actions would incorporate the cultural resource protection measures listed under the proposed action to avoid significant adverse effects.

Cultural resources could be affected by wildfire. A catastrophic wildfire in the Bald Hills could destroy barns and other structures that are one of the primary contributing elements to the Lyons' Ranches Historic District. Loss of any structure identified as a contributing element to the District would be a significant irretrievable adverse effect. To the extent that fire management actions reduce the potential for wildfires, particularly catastrophic wildfires, these actions reduce the potential for adverse effects to cultural resources that would result from a wildfire.

In all locations where actions are planned that would disturb soils, qualified park cultural resource specialists would conduct surveys prior to disturbance. Direct adverse effects on cultural resources from planned fire management actions would be avoided through identifying the resources prior to disturbance and protecting the resources. Construction of fire lines in prescribed fire units are the proposed actions that have the greatest potential for adversely affecting cultural resources. Park cultural resources specialists would survey areas where fire lines would be located and would direct crews to construct lines in locations that would avoid cultural resources. Other proposed fire management actions would occur in areas that are of low cultural sensitivity or that were previously disturbed by timber harvest or construction of roads. Cultural resource protection measures outlined in the alternatives would be used to avoid significant adverse effects under both the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP).

Under the suppression only alternative (Alternative 3), there is a greater long-term potential for moderate to major adverse effects to known cultural resources because there would be no prescribed fires or mechanical work to reduce fuels in the vicinity of cultural resources. The long-term threat to cultural resources from wildfire and emergency suppression would increase as fuel levels increase. Under the suppression only alternative (Alternative 3), there would be a long-term moderate adverse effect on the cultural landscape associated with the Lyons' Ranch Historic District as the forest encroaches and the open grassland maintained through anthropogenic fire decreases.

EFFECTS ON VISITOR EXPERIENCE AND VISUAL QUALITY

Fire management actions under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) are intended to reduce the risk of wildfire, particularly a catastrophic wildfire. Alternative 3 (suppression only) would not reduce fuels through prescribed fires, associated mechanical preparation, and shaded fuel breaks. The risk of catastrophic fire would increase over the long-term under Alternative 3. There would be greater adverse effects on visitor experience and visual quality under Alternative 3 primarily related to the direct effects of large wildfires on vegetation rather than to suppression actions, which would also occur under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP).

Wildfires would have short-term adverse effects on visitor use and enjoyment from smoke that reduces visibility and causes health problems, from closures of areas of the parks for safety, and from the destruction of vegetation. Preparations for suppression under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) such as installing water tanks or preparing roads for access would not affect visitors because most preparations would take place in areas where there is no public vehicle access. Very few visitors go to places in the parks that do not have road access, although visitors could reach these areas on foot.

Wildfires would require notification and possible evacuation of visitors. In the event of wildfire, visitor protection rangers would attempt to locate any visitors in areas that might be affected by wildfire. Visitors holding permits for backcountry camping would be located based on declared camping locations. Vehicles in parking areas in the general vicinity of wildfires would provide rangers with some information on the whereabouts of visitors. Wildfires in relatively moist low-lying old growth forests are expected to grow more slowly than in dry forests higher on slopes. The Bald Hills prairies are the area most susceptible to fast-moving wildfires. The Dolson and Lyons Ranch trails cross prairies. The parking areas for these trails are located directly off Bald Hills Road. If parked vehicles are observed in these parking lots, visitor protection rangers would attempt to locate and notify visitors who would be assumed to be somewhere along the trail. The Tall Trees Trail requires a permit issued from the Kuchel Visitor Center and a combination to a locked gate along the Bald Hills Road. In case of wildfire that would threaten visitors on the trail or the access road, park staff would use the permits to identify the vehicle and number of visitors and warn or evacuate them as needed.

Flint Ridge, DeMartin, and Nickel Creek backcountry camps are located in the vicinity of prescribed fire units under the proposed action (Alternative 1, 2010 FMP, DeMartin and Nickel Creek only) or the no action alternative (Alternative 2, 2005 FMP, DeMartin and Flint Ridge only). Free backcountry permits are required to use the camps. When campers request a permit, park staff would inform them about prescribed burn scheduling and the potential for smoke. In case of wildfire, the parks visitor protection rangers would use permits to determine if campers are using the camps and to issue warnings, and evacuate the campers if needed.

Fire management actions primarily related to prescribed fire under both the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) would adversely affect the visitor experience and visual quality in the short-term. The degree of effect is greatest in the Bald Hills

compared to other areas in the parks because the prescribed fire units are largest and most numerous in the Bald Hills, because the prescribed fire units are close to the primary visitor access route (Bald Hills Road), and because the open vistas would be more affected by poor visibility from smoke than from prescribed burns conducted in forested or hilly areas.

Prescribed burns are generally scheduled for weekdays, when visitation is lower than weekends. Press releases would be distributed in the local news media to announce temporary closures during prescribed fires. The fire closures would be for short-term, generally one to three days. Most visitation along Bald Hills Road occurs at locations between Highway 101 and the Tall Trees Trail Access Road. Most prescribed burn units are located past (south of) the Tall Trees Trail Access Road. Prescribed burns along Bald Hills Road would not affect visitor access to Redwood Creek trailhead, Lady Bird Johnson Grove or the Tall Trees Grove. Some trails like the Dolson and Lyons Ranch trails in the Bald Hills past Tall Trees Access Road would be closed temporarily. Closure of the Little Bald Hills Trail would affect some hikers, mountain bikers, and equestrians. Trail closure for prescribed fire in the Little Bald Hills would be coordinated with the USFS which manages the eastern end of the trail and the California Department of Parks and Recreation which manages Howland Hills Road and the Little Bald Hills trailhead near Stout Grove.

Prescribed fires in the Bald Hills would create smoke that would obscure visibility along the Bald Hills Road and in the Redwood Creek valley. Decreased visibility from smoke would be a short-term localized adverse effect. The NPS would post signs and institute traffic controls on the Bald Hills Road to warn visitors and other drivers about potential driving hazards from smoke drifting across the road. Health hazards to visitors from smoke from prescribed fires would be negligible because visitors would not be in smoky areas long enough to suffer adverse effects and because visitors who are sensitive to smoke would be warned about the fires through signing and through direct contacts in the visitor centers and from park staff posted along Bald Hills Road. The vistas of the prairies, old growth forests, and ocean from the Bald Hills Road would be obscured by smoke. This would be a short-term adverse effect. Smoke could affect the experience of backcountry campers on the Redwood Creek gravel bars and hikers on the Tall Trees Trail. The intensity of the effect would be greatest immediately downwind of the prescribed fire but could be more widespread, depending on meteorological conditions.

Some visitors would be disappointed to see blackened prairies following the fires. This would be a short-term adverse but localized effect that would persist until vegetation regrows. Visual quality and the visitor experience would improve following the burn when green grasses regrow after the first rains and wildflowers emerge in the spring. Prescribed fires in the prairies encourage growth of abundant wildflowers. Area residents often travel to the Bald Hills to view lupine displays following prescribed fires. In recent years, the Eureka Times-Standard (local newspaper of record) has featured stories and photographs of lupine displays, which bring visitors to the park.

Park trails in old growth and coastal areas would be unlikely to be affected by wildfires because large fires in old growth forest and cool coastal areas are rare. The coastal prescribed fire units are located on the west side of the coastal slopes facing the ocean and are not in interior valleys. The smoke from

these fires would be expected to dissipate sooner than from interior valleys where smoke could be trapped by an air inversion.

Whether a prescribed fire has a negative or a positive effect on visitors and their experience depends on the attitude of visitors and their knowledge and understanding of the role of fire in ecosystems. Some visitors would appreciate the ecological rationale for conducting prescribed burns and their experience would not be adversely affected by short-term closures, reduced visibility from smoke, and the appearance of burned vegetation following a prescribed fire. Other visitors would be opposed to prescribed fires because of the potential for a wildfire from an escaped prescribed fire, the effects of smoke on visibility and health, and the appearance of burned areas immediately after a fire. This effect would persist for different lengths of time depending on the forest type that was burned and the severity of the fire. Wildfire in the old growth redwood forest may or may not be noticeable after the fire. Many old growth redwood trees bear fire scars and hollows created by fires. It may or may not be possible for visitors to distinguish the effects of an old fire from the effects of a new fire in old growth after one season. Understory vegetation would regrow quickly after wildfires in old growth that are not severe and the adverse effect on the experience of some visitors would be correspondingly short.

Cumulative Effects on Visitor Experience and Visual Quality

Other park actions that have the potential to affect visitor experience and visual quality in the parks include watershed restoration projects, management of second growth forests, and construction of trails. Watershed restoration and second growth forest management would have greater effects on visual quality than on visitor experience, because these resource management projects occur in areas where there is currently little or no visitor use. There would be short-term adverse effects on visual quality from removal of trees and disturbance of soils from watershed restoration and second growth forest management.

Visitor experience and enjoyment of the park would be complemented by continued development of recreational opportunities in communities adjacent to the parks and in the region. Additional trails are being developed in Humboldt and Del Norte Counties, including a Humboldt Bay Water Trail; a proposed bike trail along Elk Valley Road in Del Norte County; and completion of several segments of the Kelsey Trail in the Smith River NRA adjacent to the park in Del Norte County. In addition, the General Plan amendment for the Mill Creek watershed now included in Del Norte Coast Redwoods State Park is expected to contain proposals for additional recreational activities including hiking, biking, equestrian and motor vehicle access.

Proposed construction of trails and other visitor facilities in the park under the trail and backcountry management plan approved in 2009 would have minor to moderate long-term benefits to the visitor experience.

Visual quality in the park depends on the level of previous disturbance to old growth forests within what is now the park and on how much of the viewshed includes non-park uses, such as residential, commercial and transportation facility development or commercial land uses such as logging. Areas with the highest visual quality include park beaches and shoreline, old growth forests, stream

corridors including Redwood Creek, the prairies and oak woodlands in the Bald Hills, and long-distance views from the Bald Hills. Areas of lower visual quality include road corridors through second growth forest such as the West Side Access Road and dense stands of unmanaged second growth forest.

The visual quality in areas along the primary transportation routes through the parks (U.S. Highways 101 and 199) has been affected by developments associated with human occupation, including transportation infrastructure, residential and commercial development, and commercial timber harvest. The visual quality of Hiouchi is affected by commercial, residential, and transportation developments. However, the superb visual quality associated with the Smith River and the old growth redwood forests preserved in Jedediah Smith Redwoods State Park and visible from Hiouchi would not be affected by maintenance of the shaded fuel break under either the proposed action or the no action alternative.

Conclusions (Effects on Visitor Experience and Visual Quality)

There would be short-term, localized adverse effects on the visitor experience from smoke and closures in the park in case of wildfires or from prescribed fires under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP). These effects would be negligible to major, depending on the location of wildfires, and minor in case of prescribed fires in the Bald Hills and Little Bald Hills.

The overall effect on visitor experience and visual quality under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) from prescribed burns would be temporary, localized, adverse, and negligible. The effects of prescribed fires on visitor experience and visual quality from smoke and burned vegetation would be slightly greater under the proposed action because there are about 2200 additional acres proposed for prescribed fires. Under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP), effects would be beneficial in the very long-term (decades to centuries), and negligible to moderate in the short-term, depending on whether visitors observe the areas during activities or on the length of time visitors are in an area after the activities have taken place.

Effects on visitor experience and scenic quality in the event of a catastrophic wildfire would be minor to major, depending on the location of the fire and whether winds create areas of dense smoke in the park.

EFFECTS ON PARK OPERATIONS

Under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP), fire management staff would plan, supervise, and conduct fire management activities including construction of fire lines, preparation for suppression actions, and prescribed fires. Fire management staff also prepare for suppression actions that would occur under all alternatives, including the proposed action, no action and Alternative 3 (suppression only). Park staff that are trained and meet current qualifications would assist with conducting prescribed burns and would also be available for assignments to wildfires in and out of the parks. Interpretive staff would prepare and disseminate information to visitors and the public about fire operations and effects of fire, and would act as

liaisons between the fire management operations chief and the public in the case of wildfires. Resource management staff would assist in planning and conducting prescribed burns, and would conduct research and monitor the effects of fire on resources. Resource and visitor protection staff (law enforcement rangers) would assist with management of visitors during prescribed fires and in case of wildfires. Maintenance staff would assist with any closures of roads, trails, or facilities in case of wildfire.

Fire management staff occasionally cuts and piles wood for use in park housing areas, but more wood is generated than can be used or given away. Fire and resource management staff would haul some wood generated by mechanical fuel reduction to areas where it would be cut into firewood-size pieces and removed under permits issued under the proposed action. There would be a minor increase in staff time needed to issue permits and supervise wood removal.

Cumulative Effects on Park Operations

Park operations that are affected by or affect fire management include road and facility maintenance, watershed restoration, second growth forest management, cultural resource protection and management, visitor and resource protection, and interpretation and visitor information. Resource management staff who are directly involved with fire management include cultural resource management staff for all fire operations in the Bald Hills; vegetation management staff for all fire operations; and some protection rangers who are qualified for fire fighting and helicopter operations. Road and facility maintenance staff plan and conduct road maintenance projects needed to ensure access for fire equipment. Resource management personnel conducting watershed restoration and second growth forest management projects coordinate road maintenance and repair projects with fire personnel. Protection rangers and park interpreters provide traffic control and visitor information services for prescribed burns and wildfire suppression actions.

Conclusions (Effects on Park Operations)

Effects from fire management operations on other park operations require varying time commitments. Preparation of planning documents and associated environmental documents and required consultations under the federal Endangered Species Act and the National Historic Preservation Act of 1966 has a moderate impact for several months on wildlife and cultural resource management staff. Preparation of cultural resource compliance documents for annual prescribed burns requires an additional time commitment. The effect on the park cultural resource program from the prescribed fire program is moderate and reduces the time available for other cultural resource management activities.

EFFECTS ON ADJACENT COMMUNITIES

Several communities identified as communities at risk are within 20 miles of the parks and could be affected by large wildfires that originate in the parks. These communities include Big Lagoon along US Highway 101 south of the park in Humboldt County, Hoopa and the Hoopa Valley Indian Reservation on Highway 96 east of the park in Humboldt County, Hiouchi on US 199 in Del Norte County, Gasquet on US Highway 199 northeast of the parks in Del Norte County, and Rock Creek on South Fork Road northeast of the Little Bald Hills in Del Norte County.

Proposed fire management actions under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) would have no direct effects on adjacent communities. Both the proposed action and no action would have minor indirect benefits to communities from reducing the risk of wildfires in the park. Wildfires that begin in the park would have direct adverse effects on adjacent communities if the fires burn private property or threaten human health and safety.

Five shaded fuel breaks would be created or maintained under the proposed action (Alternative 1, 2010 FMP) along Holter Ridge Road /Lost Man Creek Trail/B Line Road from the Bald Hills Road north to US Highway 101; along the Bald Hills Road from the Holter Ridge Road junction to Elk Camp Prairie; the Wolf Creek Outdoor School Access Road and housing complex/fire cache; around the Hiouchi park housing and fire cache complex; and around the Howland Hills Outdoor School access road and complex. Under the no action alternative (Alternative 2, 2005 FMP), the Howland Hills fuel break would not be created but the other four fuel breaks would be created or maintained. The shaded fuel breaks would provide more secure and defendable park boundaries, defendable spaces around park developments, and escape routes for fire personnel and park visitors in the event of a wildfire.

Woody debris generated by fuel reduction activities would be allowed under firewood permits issued under the proposed action. Removal of wood would decrease the fuel loading and fire hazard. This action is consistent with the removal of logs generated by second growth management program begun in summer 2009.

Alternative 3 (suppression only) would increase the potential over the long-term for catastrophic wildfires that could cross park boundaries and threaten human health and safety and private property. There would be no shaded fuel breaks or other preparation for fire suppression such as reduction of fuels, and no prescribed fires to reduce fuel levels in some second growth forests in the Bald Hills.

Smoke from prescribed fires under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) and from wildfires would have a short-term adverse effect on visibility and human health. The intensity and duration of the adverse effects from prescribed fires would be negligible to moderate, depending on the general health, respiratory condition, and allergy sensitivity of individuals, and temporary. Adverse effects on visibility and human health from smoke from wildfires could rise to the level of severe, depending on the size and duration of the wildfire. The intensity and duration of adverse effects of smoke from wildfires would be expected to be greater than from prescribed fires, which are permitted by the North Coast Unified Air Quality Management District only when adverse effects on visibility and health can be minimized by ensuring adequate smoke dispersion.

There would be no effects on Orick, Klamath, and Requa from prescribed fire in the Little Bald Hills and negligible effects on Crescent City. Hiouchi, the residential areas along Douglas Park Road, and Rock Creek, a small community on the South Fork of the Smith River east of the Little Bald Hills, are the communities closest to the Little Bald Hills. These communities would be affected by drifting smoke from a prescribed fire if winds blow from the south. The smoke would be temporary but the degree of effect depends on the sensitivity of individuals to smoke. Residents of these communities

are exposed to smoke from wildfires in the area on a recurring basis. These effects would be negligible based on the assumption that the Air Quality Management District would only permit the prescribed fire if smoke effects would be minimal.

For some residents in Del Norte County, smoke would be a reminder of serious threats to life and property from recent wildfires, including the catastrophic Biscuit Fire in 2002 that resulted in evacuations in Gasquet. This would be a temporary adverse effect that would affect residents differently depending on their attitude about wildfire. Most residents are very aware of the threat of wildfire. Residents who are very uncomfortable with the threat of wildfire would leave either temporarily during wildfires or move out of the area permanently. This is an unavoidable adverse effect of residing in an urban-wildland interface with burnable vegetation.

The proposed fire management program in the Bald Hills would have a negligible to minor benefit to the community of Orick to the degree that prescribed fire and mechanical fuel removal reduces the risk of catastrophic wildfire. The benefit is lessened because the prairies and oak woodlands are separated from Orick by coniferous forest.

Cumulative Effects on Adjacent Communities

Adjacent communities would be most affected by smoke and reduced visibility from large wildfires in the vicinity of the parks, with prevailing winds that move the smoke into coastal communities (Trinidad, Big Lagoon, Orick, Requa, Klamath, Crescent City) or interior communities (Hiouchi, Gasquet, Hoopa, Weitchpec, Willow Creek). The health effects and change in visibility from smoke would range from negligible to severe, depending on the location, size, and duration of the wildfire. The effects of a large wildfire on health and visibility from wildfire would be greater than the smoke impacts from any proposed fire management action, including prescribed burns in the parks. Although smoke would be a temporary effect, it could create serious health risks to sensitive individuals for as long as several months. It is unlikely that the majority of the human population of any adjacent community would suffer significant long-term health problems from smoke from a wildfire, and the short-term and long-term health risks from fire management actions would be negligible.

Air quality in adjacent communities would be reduced through the cumulative effects of burning on private lands adjacent to the parks. Burn barrels, yard vegetation that is piled and burned, wood stoves, and fireplaces would contribute smoke and reduce air quality. Open fires outside (burn barrels, lawn and garden burn piles) would be prohibited during the same periods that open fires would be prohibited in the parks. CAL FIRE sets the “fire season” dates when regulations prohibiting open fires take effect for private lands. The NCUAQMD can further restrict open fires to protect air quality. Open fires and other fires that produce air pollutants on private lands would not be expected to cause a cumulative reduction in air quality sufficient to violate air quality standards for the area.

The Del Norte and Humboldt County Fire Safe Councils and CAL FIRE conduct inspections and fuel reduction projects to protect private properties in fire-prone areas. These programs have moderate long-term benefits.

Conclusions (Effects on Adjacent Communities)

The fire management program under the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) has minor to moderate benefits to adjacent communities from prescribed fires that reduce the potential for large wildfires, from mechanical fuel reduction projects especially shaded fuel breaks, and from preparations for suppression that enable the park fire management staff to prevent the spread of wildfires. The greatest benefit to adjacent communities is from the shaded fuel break between park lands and Hiouchi, which is in a fire-prone area adjacent to the park.

NON-IMPAIRMENT OF PARK RESOURCES AND VALUES*Potential for Impairment from Catastrophic Wildfire*

There is a potential for impairment to all park resources in the event of a catastrophic wildfire from both the fire and associated suppression activities, even with rehabilitation that follows a catastrophic fire. Under the suppression only alternative (Alternative 3), the long-term potential for a catastrophic wildfire would increase as fuels increase without active management to reduce excess fuels. Therefore, the suppression only alternative increases the potential for impairment over the long term. Based on the likelihood of a catastrophic wildfire occurring within the 5-year life of the fire management plan (2010 through 2015), the suppression only alternative is not expected to impair park resources. Suppression of small wildfires under any of the alternatives is not expected to impair park resources because of the limited area that would burn before the fire is contained, controlled, and extinguished.

Non-Impairment of Air Quality

None of the alternatives [the proposed action (Alternative 1, 2010 FMP); no action (Alternative 2, 2005 FMP); or Alternative 3 (suppression only)] would have long-term adverse effects on air quality or air quality related values in the parks. Short-term adverse effects on air quality from the action alternatives would be negligible for construction and maintenance of shaded fuel breaks, historic structure protection, and preparation for suppression. Short-term adverse effects from smoke from pile burning would have very localized minor adverse effects. Broadcast burns would have moderate adverse effects because burn units could be several hundred acres. Adverse effects on air quality from suppression actions under Alternatives 1 and 2 and under Alternative 3 (suppression only) result from wildfires, not from suppression actions, and are likely to be more severe than under prescribed fires that are only ignited under specific conditions. Air quality would return to good to excellent several days after the burn or wildfire is extinguished.

Therefore, the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) would not impair air quality or air quality related values in the park.

The adverse effects on air quality from prescribed fire under either Alternative 1 or Alternative 2 would be localized, short-term, and negligible to moderate. The prescribed fire program is needed to achieve the goals and objectives of the 1999 GMP. Therefore, short-term moderate localized adverse effects on air quality are acceptable.

Non-Impairment of Soils, Topography, and Geology

Under the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP), there would be no new effects on soils, topography, or geological resources. Most of the adverse effects on soils and topography in the park occurred in forested areas and some Bald Hills prairies and oak woodlands. Some soils and topography in these areas, especially forested slopes, were impaired by the original logging and road construction. Impairment to soils is gradually being reduced as vegetation regrows and soil formation processes act over the long-term. Topography in logged or roaded areas would remain altered and in some areas impaired by the original clearcut tractor logging and road construction until watershed restoration treatments are implemented.

Minimum impact suppression tactics (MIST) and burned area emergency rehabilitation (BAER) actions are intended to reduce adverse effects to soils, water resources, sensitive species, and cultural resources from suppression of wildfires. MIST would be employed during suppression actions in the most sensitive resource areas to reduce adverse effects on resources that result from the suppression actions rather than the fire itself. Any areas of soil exposed or damaged by heavy equipment during suppression actions would be rehabilitated after emergency fire operations are completed. BAER would be done after a severe wildfire where an emergency situation exists that continues beyond the actual fire emergency, such as the potential for severe soil erosion on steep slopes from heavy rains in the winter after a wildfire.

There would be negligible short-term adverse effects to localized areas of soils from construction of hand lines under all alternatives, either for prescribed fire or suppression, and hand lines would be rehabilitated after the fire is extinguished. Under the suppression only alternative (Alternative 3), there is a long-term potential for impairment to soils from a catastrophic wildfire and from construction of firelines using bulldozers; the potential for impairment increases as the threat of a catastrophic wildfire increases as fuels build up.

Therefore, the proposed action (Alternative 1, 2010 FMP) and the no action alternative (Alternative 2, 2005 FMP) would cause further impairment to soils or topography. Under the suppression only alternative (Alternative 3), there is a long-term potential for impairment to soils in the event of a catastrophic wildfire.

Adverse effects to localized areas of soils from construction of hand lines under all alternatives, either for prescribed fire or suppression of small wildfires, are acceptable because the hand lines are needed to prevent more extensive damage from escaped fire. Rehabilitation of firelines after either prescribed fire or a wildfire would prevent long-term damage to soils.

Non-Impairment of Water Resources, including Water Quality, Floodplains and Wetlands

Under the proposed action (Alternative 1, 2010 FMP), adverse effects on water quality in Copper Creek near its confluence with Redwood Creek from ash sedimentation are expected to be minor because the shaded riparian zone would ensure a “cool” burn with unburned vegetation acting as a filter to prevent most ash from entering the stream. Adverse effects on water quality in Redwood Creek from ash sedimentation associated with the Wildcat prescribed burn are expected to be negligible because a rain event large enough to mobilize ash sediment after the burn would result in

high flows that would quickly dilute ash sediment. A high flow event in Redwood Creek early in the season generally causes decreased water quality from sediment from failing roads in and upstream of the park; ash sedimentation would have a negligible cumulative adverse effect. Water quality in Copper Creek downstream from the Wildcat prescribed fire unit would be monitored before and after a prescribed burn to determine any effects on water quality from a prescribed burn.

Adverse effects on water quality, floodplains or wetlands from previous logging and road building are significant. Water quality, the floodplain of Redwood Creek, and riparian wetlands in the park were impaired by logging and road construction prior to becoming part of the park. This impairment to watersheds was a primary reason for park expansion. The effects on watersheds in the park from past logging and the resulting park expansion legislation are directly responsible for the definition of impairment and the “no derogation” standard that applies to management of all units in the national park system (2006 Management Policies, NPS 2006a). If major storms cause remaining roads to fail, and eroded sediment enters a perennial stream, water quality and riparian wetlands associated with that stream might again be impaired in some areas depending on the intensity of the storm and the extent of erosion. The existing impairment to water quality, floodplains, and riparian wetlands in areas affected by logging and road building is gradually decreasing over the very long-term as watershed restoration projects are completed and as watersheds recover with regrowth of vegetation.

Planned fire management actions under all alternatives would not have adverse effects on floodplains and wetlands. Effects on water quality under the proposed action (Alternative 1, 2010 FMP), no action alternative (Alternative 2, 2005 FMP), or Alternative 3 (suppression only) are primarily indirect effects from runoff of soils disturbed for fire line construction; these effects would generally be negligible because planned actions under the proposed action and no action alternative would occur away from streams. Runoff of disturbed soils from suppression actions under Alternative 3 would be minimized by MIST and BAER techniques. Adverse effects on water quality in Coyote Creek and Redwood Creek from prescribed fire in the Wildcat unit under the proposed action (Alternative 1, 2010 FMP) are anticipated to be short-term and negligible. Therefore, water quality would not be further impaired under any of the alternatives for either prescribed fire or suppression of small wildfires.

The indirect adverse effects on water quality from minor soil disturbance from planned fire line construction and potential short-term effects from ash sedimentation are negligible. These adverse effects would be acceptable because fire is needed to manage exotic plants and conifer encroachment that reduces the extent of oak woodlands and prairies; to restore and maintain cultural landscapes; and to reduce potential for more severe adverse effects on water quality that could result from increased risk of catastrophic fires over the long-term under a suppression only alternative.

Non-Impairment of Vegetation Resources

Clearcut logging impaired old growth forest communities. The effects on watersheds and old growth forests from past logging and the resulting park expansion legislation are directly responsible for the definition of impairment and the “no derogation” standard that applies to management of all units in the national park system (2006 Management Policies). The impairment to vegetation on about 850 acres is being reduced through the second growth management program by shortening the time for

these forests to reattain old growth forest characteristics, structure, and function. The impairment to park forests would continue for centuries on the 48,300 acres of untreated second growth forest outside the project area.

Oak woodlands and grasslands in the Bald Hills are identified as significant resources in the 1999 GMP/FEIS. Prescribed fires in the Bald Hills under the proposed action (Alternative 1, 2010 FMP) and the no action alternative (Alternative 2, 2005 FMP) are intended to maintain and restore the oak woodlands and prairies. Under Alternative 3 (suppression only), there is a potential for further impairment of park forests, oak woodlands, and prairies from increased risk of catastrophic fires over the long-term as fuels increase in unmanaged second growth forests, and loss of oak woodlands and prairies as conifer encroachment continues.

Removal of woody debris generated by fuel reduction activities by issuing firewood permits under the proposed action is acceptable because this would decrease the fuel loading and fire hazard. This action is consistent with the removal of logs generated by second growth management program begun in summer 2009.

Excluding fire from oak woodlands and prairies would potentially cause an impairment to these resources that are identified as significant in the park expansion legislation and the 1999 GMP/EIS. Short-term adverse effects on vegetation that is consumed by fire in prescribed burn units under the proposed action (Alternative 1, 2010 FMP) and the no action alternative (Alternative 2, 2005 FMP) are acceptable because that is the intended effect of prescribed fire and is needed to achieve the goals of fire management outlined in the 1999 GMP/FEIS.

Non-Impairment of Wildlife Resources

The no action alternative (Alternative 2, 2005 FMP) would not have direct adverse effects on fish or aquatic biota because there are no perennial or fish-bearing streams that would be affected by prescribed fire under this alternative. Effects on fish and aquatic biota in Redwood Creek from prescribed fire in the Wildcat prescribed fire unit under the proposed action have been determined to be short-term and minor from a slight decrease in water quality if there is a large rain event immediately following a prescribed burn in the unit.

Therefore, fish populations and aquatic biota would not be impaired under the proposed action or the no action alternative. The impairment to fish populations and aquatic biota in park streams outside the project area, including Redwood Creek, would continue but is lessening as the habitat recovers, watershed management practices outside the parks improve, and watershed restoration occurs both in and outside the park. Aquatic biota also benefit from projects to restore anadromous fisheries in streams in the park and throughout the region.

The original logging caused an impairment to park wildlife populations from destruction and degradation of habitat but that impairment is gradually decreasing as forests regrow. Adverse effects on wildlife from prescribed fire and preparations for fire are localized, short-term, and negligible. Prescribed burn units have been planned to provide unburned areas to serve as refugia for wildlife.

Therefore, there would be no impairment to wildlife resources under the proposed action (2010 FMP, Alternative 1) or the no action alternative (Alternative 2, 2005 FMP).

Adverse effects on wildlife would be acceptable because the loss of habitat from prescribed fire and construction of shaded fuel breaks is short-term, localized, and negligible.

Non-Impairment of Sensitive, Threatened, and Endangered Species

Some prescribed fires and preparation for these fires and construction or maintenance of shaded fuel breaks under both the proposed action (Alternative 1, 2010 FMP) and no action (Alternative 2, 2005 FMP) may cause temporary and minor degradation of spotted owl habitat. There would be a minor long-term benefit to spotted owl habitat from removal of small trees that would promote faster growth of larger trees.

The proposed action (Alternative 1, 2010 FMP) may affect and is likely to adversely affect California coastal Chinook salmon, northern California steelhead trout, and/or southern Oregon/northern California coastal coho salmon, and designated critical habitat for these species. The effect would be localized, temporary, and minor. The NPS determined, and the USFWS concurred, that the proposed action would not affect the Oregon silverspot butterfly. The NPS determined, and the USFWS concurred, that the proposed action (Alternative 1, 2010 FMP) may affect but is not likely to adversely affect marbled murrelets or their designated critical habitat, northern spotted owls, or western lilies. Adverse effects on these species are indirect effects from changes to habitat. Short-term adverse effects on habitat would be localized and minor. Long-term effects are related to habitat improvement and would be localized, beneficial, and minor.

The no action alternative (Alternative 2, 2005 FMP) may affect but is not likely to adversely affect California coastal Chinook salmon, northern California steelhead trout or southern Oregon/northern California coastal coho salmon and their critical habitat (NPS 2004c). The NPS determined, and the USFWS concurred, that Alternative 2 (2005 FMP, no action) would not affect the Oregon silverspot butterfly, bald eagle, or critical habitat for the marbled murrelet.

Therefore, the proposed action and the no action alternative would not result in impairment to populations of any listed threatened or endangered species in the park.

Adverse effects on listed species under either the proposed action (Alternative 1, 2010 FMP) or no action (Alternative 2, 2005 FMP) have been determined to be short-term, localized, and minor. Potential adverse effects on listed fish from short-term decreases in water quality in Redwood Creek under the proposed action (Alternative 1, 2010 FMP) would be minor. The number of fish that would be affected is presumed to be very small and there would be no effect on overall population of any fish species. Therefore, this minor impact is acceptable. Adverse effects on other species from habitat degradation have been determined to be minor and short-term. There would be long-term benefits to the same species from long-term improvement of habitat. Therefore, the short-term adverse effects are acceptable.

Non-Impairment of Cultural Resources

Planned actions that have the potential to affect cultural resources include prescribed fire, and any ground disturbing activities associated with preparation, suppression, and staging of fire management actions. These planned actions would incorporate the cultural resource protection measures listed under the proposed action (Alternative 1, 2010 FMP). These protection measures also apply to the no action alternative (Alternative 2, 2005 FMP). There have been no adverse effects on known cultural resources from implementation of planned fire management activities under the no action alternative (Alternative 2, 2005 FMP). Therefore, none of the planned fire management actions under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) would impair cultural resources.

A catastrophic wildfire in the Bald Hills could destroy barns and other structures that are the primary contributing elements to the Lyons' Ranches Historic District. Loss of any structure identified as a contributing element to the District would be a significant irretrievable adverse effect. To the extent that fire management actions (prescribed fires, fuels reductions around historic structures) under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) reduce the potential for wildfires, particularly catastrophic wildfires, these actions reduce the potential for impairment to cultural resources that would result from a wildfire.

Direct adverse effects on cultural resources from planned fire management actions would be avoided through identifying the resources prior to disturbance and protecting the resources. Construction of fire lines in prescribed fire units are the proposed actions that have the greatest potential for adversely affecting cultural resources. Park cultural resources specialists would survey areas where fire lines would be located and would direct crews to construct lines in locations that would avoid cultural resources. Other proposed fire management actions would occur in areas that are of low cultural sensitivity or that were previously disturbed by timber harvest or construction of roads. Therefore, the proposed fire management actions under the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) would not impair cultural resources.

There is a potential for adverse effects to cultural resources under Alternative 3 (suppression only) from lack of mechanical fuel reduction around historic structures and lack of prescribed fires in the Bald Hills. As fuels increase, there is an increased potential for impairment to cultural resources in the Bald Hills under Alternative 3 (suppression only) over the long-term.

Non-Impairment of Scenic Values and Opportunities for Enjoyment

There would be short-term localized adverse effects on scenic quality from burned vegetation after prescribed fires under either the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP). These effects are temporary and disappear within several weeks as rains bring on a flush of new growth. In the first or second spring following a prescribed burn, wildflowers bloom in the Bald Hills grasslands, creating spectacular displays that have been the subject of articles in local newspapers.

Shaded fuel breaks are constructed in areas of dense fuels that resulted from logging operations along roads. The fuel breaks create openings in dense vegetation that slightly improve scenic quality.

These fire management actions under either the proposed action (Alternative 1, 2010 FMP) or the no action alternative (Alternative 2, 2005 FMP) would not impair scenic quality in the park.

Short-term adverse effects on scenic values immediately following the burns are acceptable because the fires are needed to preserve the grasslands that are a significant resource identified in park legislation, the 1999 GMP/FEIS, and because the wildflower displays are a significant but temporary scenic value.

Under Alternative 3 (suppression only), the long-term potential for catastrophic wildfire would increase. MIST procedures for suppression and BAER practices following suppression would reduce adverse effects on scenic quality but catastrophic wildfires could result in significant long-term adverse effects on scenic quality from consumption of vegetation and suppression actions. Alternative 3 has a potential to impair scenic values in the park over the long-term.

COORDINATION and CONSULTATION

Recipients of the Environmental Assessment

The following officials, agencies, American Indian tribes, and organizations received a copy of the environmental assessment or a letter announcing its availability and its location on the Internet. Individuals who received a copy or announcement are not listed. All recipients are in California unless otherwise noted.

Congressman Mike Thompson
State Senator Sam Aanestad
State Senator Patricia Wiggins
Assemblyman Wesley Chesbro
Del Norte County Board of Supervisors
Humboldt County Board of Supervisors

Bureau of Land Management, Arcata
NOAA Fisheries, Arcata
United States Fish and Wildlife Service, Arcata
Six Rivers National Forest, Eureka
Gasquet Ranger District, Six Rivers National Forest, Gasquet
United States Geological Survey, Western Ecological Research Center, Sacramento

California Department of Fish and Game, Eureka
CAL FIRE, Crescent City
CAL FIRE, Fortuna
California State Office of Historic Preservation, Sacramento
North Coast Regional Water Quality Control Board, Santa Rosa
North Coast Unified Air Quality Management District, Eureka

Big Lagoon Rancheria
Elk Valley Rancheria
Hoopa Valley Tribe
Resighini Rancheria
Smith River Rancheria
Tolowa Nation
Trinidad Rancheria
Yurok Tribe

Able Forestry, Eureka
Barnum Timber, Eureka
Blue Ribbon Coalition, Oakley
California Native Plant Society, Arcata
Del Norte Fire Safe Council, Crescent City
Feller and Associates, Crescent City
Green Diamond Resource Company, Korbel
Department of Biological Sciences, Humboldt State University, Arcata
Department of Forestry, Humboldt State University, Arcata
Department of Natural Resource Planning and Interpretation, Humboldt State University, Arcata
Friends of Del Norte, Crescent City
Humboldt Fire Safe Council, Eureka
Klamath Chamber of Commerce, Klamath
National Parks Conservation Association, San Francisco
Natural Resource Management Corporation, Eureka
Northcoast Environmental Center, Arcata
Northcoast Regional Land Trust, Arcata
Orick Chamber of Commerce, Orick
Orick Community Services District, Orick
Redwood Region Audubon Society, Arcata
Save-The-Redwoods League, San Francisco
Sierra Club North Group, Arcata
Sierra Pacific Industries, Weaverville
Siskiyou Project, Cave Junction OR
Smith River Alliance, Crescent City
Stillwater Sciences, Inc., Arcata
Western Timber, Arcata

Del Norte County Public Library, Crescent City
Humboldt County Library, Arcata
Humboldt County Library, Main Branch
Humboldt County Library, McKinleyville Branch
Humboldt State University Library, Arcata

Coordination and Consultation

The following were consulted in or contributed to the preparation of this environmental assessment. All personnel are located in offices in California.

Redwood National and State Parks

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- Keith Bensen. Fish and Wildlife Biologist. Orick. (ESA consultations)
- Greg Bundros. Geologist. Arcata.
- Karin Anderson Grantham. Cultural Resources Program Manager. Orick. (Cultural resource consultations, EA sections)
- McClelland, John. Fuels Technician. Orick.
- Parkinson, Aida. Supervisory Environmental Specialist. Orick. (EA preparer, impact analyses)
- Schmidt, Kristin. Wildlife Biologist. Orick.
- Taraoka, Jason. Forester. Orick.
- Wartella, Judy. GIS Specialist. Orick. (GIS analyses, maps.)
- Young, Rick L. Fire Management Officer. Orick. (Fire management plan preparer)

Other Agencies

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Other Consultants

- Ken Hanson. Lepidopterist. McKinleyville.
- Sterling Mattoon. Lepidopterist. Chico.
- Joel Thompson. Wildlife Biologist. Green Diamond Resource Co. Korb.

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