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Final Environmental Impact Statement

Orleans Community Fuels Reduction and Forest Health Project

Orleans Ranger District, Six Rivers National Forest
Humboldt County, CA

T. 10 N., R. 5 E., Sections 1, 12, 13; T. 10 N., R. 6 E., Sections 4 - 9, 16 - 17; T. 11 N., R. 5 E., Sections 1, 12, 13, 24, 25, 36; and T. 11 N., R. 6 E., Sections 4 - 9, 16 - 21, and 28 - 33

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Orleans Community Fuels Reduction and Forest Health Project
Final
Environmental Impact Statement
Humboldt County, CA

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Abstract: The Six Rivers National Forest proposes to respond to hazardous fuels and forest health concerns around the community of Orleans, California, on the Orleans Ranger District, Six Rivers National Forest. The area affected by the proposal includes National Forest System lands administered by the Orleans Ranger District in Humboldt County, California, specifically within the upper tributaries of the LMK watersheds. The Orleans Community Fuels Reduction (OCFR) and Forest Health Project Final Environmental Impact Statement (FEIS) describes the proposed action and no action alternatives and discusses the estimated effects of implementing each of the alternatives. It compares the alternatives in terms of meeting management objectives and estimates impacts to resource values of concern, based on comments received from the public on the previously released Draft Environmental Impact Statement (DEIS).

The FEIS was mailed out on June 13, 2008, to those who submitted specific written comments related to the project. The project was planned under authorities outlined in the Healthy Forest Restoration Act of 2003. The Responsible Official who will issue a decision on this project is Tyrone Kelley, Forest Supervisor. A copy of the FEIS and additional information regarding this proposed project can be obtained from: William Rice, District Ranger Orleans Ranger District, Highway 96, P.O. Box 410, Orleans, CA 95556, phone number (530) 627- 3291. This proposed project is subject to the objection process pursuant to 36 CFR Part 218 Subpart A and is not subject to notice, comment and appeal procedures under Part 215 (218.3).

Objections will be accepted only from those who have who have filed written comments during the DEIS formal comment period (40 CFR 1506.10). The objection must contain at a minimum, a sufficient narrative description of those aspects of the proposed project objected to, specific concerns related to the project, and suggested remedies that would resolve the objection. Incorporation of documents by reference shall not be allowed. Objections may be submitted by e-mail in Word (.doc), rich text format (.rtf), text (.txt), and hypertext markup language (.html) to appeals-pacificsouthwest-regional-office@fs.fed.us.

Summary

The Six Rivers National Forest, in collaboration with the Orleans Fire Safe Council, the Karuk Tribe, environmental groups, community members and forest industry, is proposing the Orleans Community Fuels Reduction (OCFR) and Forest Health Project. The project area includes National Forest System lands administered by the Orleans Ranger District in Humboldt County, California, specifically within the upper tributaries of the LMK watersheds. This action is needed because the overall area has a high potential for high-intensity, severe wildfires.

The action proposed by the Forest Service is to treat approximately 2,698 acres of forest lands by either thinning and/or pruning, hand piling and burning, jackpot burning, yarding tops, and/or understory burning to increase wildfire suppression effectiveness in and around the community of Orleans.

Hazardous fuels would be reduced along ridges and key locations adjacent to and within the Orleans Community. Surface and ladder fuels would be reduced to allow cultural burning and maintenance through prescribed fire. In a few areas only accessible by foot and adjacent to private property, surface and understory ladder fuels on federal lands would be cut and treated by hand, within a 300-foot buffer of the property line.

In addition, proposed vegetation treatments would reduce the density of understory, low- to mid-canopy-level and codominant trees, while promoting the development of large trees. Some canopy-level thinning would occur to promote the growth of mast-producing hardwoods and diverse forest structures. Canopy thinning by selective whole-tree removal would occur in a few select places to provide clear visibility from viewpoints associated with spiritual activities.

In general, under the no action alternative, a higher probability of crown fires would continue throughout the project area. Fuels would continue to build reducing the success of reintroducing natural and prescribed fires. Under the proposed action alternative, fire-resilient forests would be created with reduced hazardous fuel accumulations and would better support the reintroduction of fire-adapted ecosystem functions, including natural, cultural, and prescribed fire.

Under the no action alternative, restoration of a landscape supportive of cultural burning would not be enhanced. Under the proposed action alternative, conditions that support cultural burning would be created by lowering the density of surface and ladder fuels. In addition, clear visibility to spiritually important viewsheds would be provided, enhancing values in the Panamnik World Renewal Ceremonial District.

Canopy closures of 60 percent would be maintained in all currently suitable Northern Spotted Owl nesting/roosting habitats for this project. This percent closure limits the ability to reduce stand densities; however, it does meet the purpose and need of reducing surface and ladder fuels while maintaining species habitats.

The 406 acres of riparian reserve treatments under the proposed action alternative would accelerate the recovery of vegetation in plantations, including the recruitment of large woody debris and promotion of fire-resilient streamsheds.

The proposed action analyzed in the final environmental impact statement (FEIS) was developed through the collaborative process led by the Fire Safe Council and balances the interests of the local community, agencies, tribes and industry to the extent possible. All meetings were open to the public and posted. Based upon the effects of the alternatives, the responsible official will decide whether the proposed action will proceed as proposed.

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Chapter 1. Purpose of and Need for Action

The Six Rivers National Forest, in collaboration with the Orleans Fire Safe Council, the Karuk Tribe, environmental groups, community members and forest industry, is proposing the Orleans Community Fuels Reduction (OCFR) and Forest Health Project. The project area includes National Forest System lands administered by the Orleans Ranger District in Humboldt County, California, specifically within the upper tributaries of the Lower Middle Klamath (LMK) watersheds. The project planning area is located in T. 10 N., R. 5 E., Sections 1, 12, 13; T. 10 N., R. 6 E., Sections 4 - 9, 16 - 17; T. 11 N., R. 5 E., Sections 1, 12, 13, 24, 25, 36; and T. 11 N., R. 6 E., Sections 4 - 9, 16 - 21, and 28 - 33 (Appendix A - Map 1). This action is needed because the overall area has a high potential for large, sustained, severe wildfires.

The Forest Service has prepared this final environmental impact statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This FEIS discloses the direct, indirect, and cumulative environmental impacts that could result from the proposed action and alternatives.

Background

On August 22, 2002, President Bush announced the Healthy Forest Initiative (HFI) for Wildfire Prevention and Stronger Communities. The Healthy Forests Initiative implements core components of the consensus 10-year Implementation Plan agreed to by states, tribes, and stakeholders. The proposed treatments in the OCFR Project further the goals of the President's initiative. They would reduce the threat of catastrophic wildfires to protect communities, firefighters, wildlife and forest health.

Other federal direction includes the National Fire Plan (Managing the Impact of Wildfires on Communities and the Environment, A Report to the President; USDI and USDA 2000), Federal Wildland Fire Policy (USDI et al. 1995 with updates in 2001), and the Healthy Forests Restoration Act (Healthy Forest Restoration Act; 2003).

The OCFR Project qualifies as a Healthy Forest Restoration Act project because: (1) the Orleans community has been designated as a "Community at Risk" from wildfire (Federal Register, August 17, 2001, Vol. 66, No. 160), and (2) associated residential developments are within an established wildland urban interface (WUI) for the Six Rivers National Forest.

Environmental review of the proposal has been conducted as required by the National Environmental Policy Act of 1969 (NEPA). This includes compliance with NEPA-implementing regulations of the Council on Environmental Quality (CEQ) at 40 CFR Part 1500, and application of both the CEQ's Guidance for Environmental Assessments of Forest Health Projects of December 9, 2002 and Forest Service Handbook 1909.15—Environmental Policy and Procedures Handbook.

Existing Conditions – *Why Here, Why Now?*

The following paragraphs describe the present conditions that are at risk due to wildfire in the OCFR planning area. These conditions describe why the proposed action is needed in this location, at this time. These existing conditions demonstrate the need to reduce fuels to provide public and firefighter health and safety, to protect forest communities of concern, to protect critical habitats of threatened, endangered, and sensitive species and to protect and enhance cultural uses of the forest.

Wildfire Risk Rating

The project location encompasses the majority of private land and structures in the Orleans Community area. To assess past fire occurrence trends and expected future fire occurrence, a risk rating is calculated using a standard formula. This standard risk formula is based on the number of fire starts, the number of years of historical information, and the number of acres involved:

Risk rating = [(x/y)*10]/z, where:

x = number of starts recorded for the chosen area
y = number of years records cover
z = number of acres analyzed, displayed in thousands (8.571 – acres within Forest Service and private land)

Risk ratings, ranges of values, and interpretations of these values are shown in Table 1.

Table 1. Fire risk ratings and values

Risk	Values	Interpretation
Low	0-.49	At least one fire expected every 20 or more years per thousand acres
Moderate	.5-.99	At least one fire expected in 11-20 years per thousand acres
High	>1.0	At least one fire expected in 0-10 years per thousand acres

The fire risk rating for the project was based on the project area plus an adjacent 0.25-mile buffer (8,571 acres). Table 2 shows fire risk values and ratings for the project by decade, with data only available up to 2005. These data show that fire risk has been consistently high (at least one fire expected in 0 to 10 years per thousand acres) since the 1960s, with a dramatic increase in fire occurrence since the year 2000.

Table 2. Risk values and ratings for project area plus 0.25-mile buffer

Period	Number of Fires	Number of Years	Risk Value	Risk Rating
1910-1919	13	10	1.52	High
1920-1929	12	10	1.40	High
1939-1939	3	10	0.35	Low
1940-1949	2	10	0.23	Low
1950-1959	6	10	0.70	Moderate
1960-1969	10	10	1.17	High
1970-1979	9	10	1.05	High
1980-1989	9	10	1.05	High
1990-1999	18	10	2.10	High
2000-2005	18	6	3.50	High

At the same time as these high numbers of fire occurrences, there have been at least six fires since 1973 within 10 miles of the project area that have exhibited extreme fire behavior:

- Offield Fire (1973) 8,100 acres
- Hog Fire (1977) 80,000 acres
- Megram Fire (1999) 125,000 acres
- Dance Fire (2001) 30 acres
- Windy Fire (2000) 70 acres
- Geary Fire (2005) 175 acres
- Somes Fire (2006) 15,590 acres

These wildfires had flame lengths exceeding 100 feet during uphill and wind-driven runs and even during backing fires as single trees and clumps of trees burned as crown fires. Strategic locations to fight fire are limited or need clearing to allow safe fire suppression and escape in the event of fire. Vegetation type, composition and structure are the variables that can be influenced to reduce the threat of intense fires.

Wildfire Hazard

Wildfire hazard was analyzed within the LMK Watershed Analysis (2003) based on inputs of fuel models, slope classes, and weather. Modeled outputs of rates of spread (ROS) and flame lengths (FL) were displayed for August (i.e., 90th percentile) weather inputs to represent severe summertime conditions. These two critical fire behavior parameters affect resistance to control and suppression effectiveness, in terms of whether hand crews, equipment, or aerial attack can successfully suppress a wildfire. Standard groupings for rates of spread and flame length, with their corresponding suppression effectiveness assessments, are shown in Table 3.

To emphasize those areas that have a high probability of exceeding initial attack capability under severe summer conditions, Appendix A – Map 2 displays only the coincident high, very high, and extreme (i.e. August) rates of spread and flame length fire behavior (including a 0.25-mile buffer around the project area). It is evident that extensive areas in and around the treatment units could exceed initial attack capability when a wildfire occurs under these conditions. Fires that require heavy machinery and/or aerial attack would be associated with the greatest potential for larger, more destructive wildfires that can have extensive crown fire and higher tree mortality.

Table 3. Wildfire hazard ratings based on rate of spread, flame length, and suppression effectiveness

Value	Rate of Spread (ft/min)	Flame Length (ft)	Suppression Effectiveness
Low	0-5	0-2	3-person hand crew or engine
Moderate	5.1-11	2.1-4	5-person hand crew or engine
High	11.1-22	4.1-6	engines/hand crews/water tender plus aerial attack
Very High	22.1-33	6.1-8	all above plus dozers/aerial support
Extreme	33.1+	8.1+	beyond initial attack, into extended attack

Stand Density

The vegetation in the proposed action area ranges from brush to old-growth seral stages. Encompassed within these stands are approximately 1,010 acres of plantations and 41 acres of old growth (Table 4).

Table 4. Seral stage acres in the proposed action area

Early Mature	351
Mid Mature	784
Late Mature	505
Old-Growth	41
Plantation (Pole/Shrub)	1,010
Other	7
Total Acres	**2,698**

Within the general project area, within spotted owl habitat, and within riparian reserves, stand densities exceed the regional goals (less than 60 percent of maximum stand density index (SDI) for healthy growth of trees and vegetation. High stand densities increase mortality, reduce the health and vigor of the stand, and increase susceptibility to insects and disease. Figure 1 depicts the heavy fuels present in the planning area.

The project area complements work being accomplished in two other projects: (1) Orleans Community Protection Project A (Orleans CPPA 3-2-2004), which reduces fuels within the defense zone, 300 feet along both sides of key roads and within 300 feet adjacent to private property (north of Highway 96); and (2) Hazel Project (9-17-2002), which reduces surface and ladder fuels along a key ridge feature bordering the Orleans Community and lower Boise Creek drainage (Appendix A - Map 3). The OCFR Project complements these efforts and provides an over-all landscape approach to fire management and fuels reduction to further protect the community and surrounding wildlife habitats.

Figure 1. Fuel accumulation in forest stand

In addition, this project complements the local Fire Safe Council and private landowner's fuel reduction activities on private lands, supporting the Orleans Community Wildfire Protection Plan (Mid Klamath Watershed and Fire Safe Council 2008).

As stated in the LMK Watershed Analysis (US Forest Service 2003), returning to more of a pre-European settlement fire regime (which is generally a low-intensity, short interval, stand-maintaining regime with scattered areas of high intensity), would contribute to a forest that is more resilient to the effects of wildfires, and reduce the probability of catastrophic fire. These low to moderate intensity wildfires would allow fire suppression to be conducted more effectively and safely, and could increase the protection of communities and natural resources.

Purpose and Need for Action

The purpose of this project is to manage forest stands to reduce hazardous fuel accumulations and improve forest health around the community of Orleans, while enhancing cultural values associated with the Panamnik World Renewal Ceremonial District. More specifically, the need for this project and why action is needed now, consists of the following reasons:

- **Reduce hazardous fuel accumulations on forest lands surrounding the community of Orleans to allow safe and effective fire suppression for fire-fighting crews in the event of a wildfire. Promote restoration of fire-adapted ecosystem functions, such that when fire returns to the ecosystem, adverse impacts are minimized (**National Fire Plan and HFRA**).** This area includes the lands within the project planning area and the surrounding forest;

  Presently, the flame lengths that would occur in a wildfire under severe fire weather conditions in the project area would range from 42 to 82 feet. The desired future condition after fuel treatments have been implemented would be:

  1. Surface fire flame lengths less than four feet, resulting in less torching and reduced basal area mortality when a fire occurs within the project area.

Flame Length

Flame length is the average length of the flame front from the ground to the flame tips and it is used as one measure of firefighting effectiveness

- **Enhance cultural values associated with the Panamnik World Renewal Ceremonial District through improved forest health and a reduction of fuels** (Forest Plan, p. IV–114);

  There are 9,840 acres within the OCFR planning area that are located within the Panamnik World Renewal Ceremonial District and 941 acres within the OCFR project units that would be treated. Historically, regular low-intensity cultural burning was used to maintain desirable forest conditions for the production and gathering of foodstuffs, basketry materials, and game species. Stand conditions were much more open than today, both in the understory and canopy levels, a lower proportion of conifers was also present. Today, pretreatment of vegetation to reduce existing understory and canopy densities is often needed before traditional burning techniques can be implemented to achieve and maintain desirable conditions. Plantations, which were created after harvesting, are also a factor contributing to fuel build-up and increased stand density. With the cessation of traditional cultural burning and the suppression of natural fires over the last 100 years, encroachment and growth of Douglas-fir trees has left some important views for spiritual activities totally obscured. Removal of select canopy level trees is now necessary to restore these views. The desired future condition is to:

  1. Increase the acres of vegetation available for maintenance through cultural burning.
  2. Open five vistas to enhance spiritual values.

- **Improve forest health by reducing stand densities and promoting the development and maintenance of diverse stand structures and species composition** (Forest Plan, p. IV–77);

Almost all stands contain very high densities of trees, with an average of greater than 1,200 trees per acre for all stands combined. A few stands exceed 4,000 trees per acre. The average percentage of maximum stand density index (SDI) is now in excess of 60 percent for all stands combined. During low precipitation years, the rate of natural thinning/mortality will increase, contributing additional material to the fuel load. In general terms, what were once more open canopies of large hardwoods and scattered conifers, with some patches of dense hardwoods and/or conifers, have now developed into consistently dense canopies containing a far greater proportion of Douglas-fir trees and significantly fewer nut-producing hardwoods. The previous relatively open patchwork or mosaic of younger age classes and diverse species in the understory has given way to a relatively consistent layer of small and medium-sized tanoak and Douglas-fir trees with fewer species of plants present. The desired future condition is to:

1. Reduce stand densities and maintain them at less than 60 percent of maximum stand density;
2. Increase average tree diameters (quadratic mean DBH in inches); and
3. Maintain a healthy hardwood component well into the future (average percent of total basal area in hardwoods).

- **Accelerate development of resilient riparian reserves with late-seral characteristics** (Forest Plan, Aquatic Conservation Strategy).
  Presently, there is a need to manage vegetation within portions of the riparian reserves to accelerate the development of late-successional forest characteristics in overstocked shrub, pole, and early mature stands. The desired future condition is to:
  1. Treat acres within the riparian reserves to reduce fuel accumulations.
  2. Increase the acres of fire resiliency in the riparian reserves
  3. Increase acres of large woody debris (LWD) recruitment

Proposed Action

The proposed action is designed to respond to the purpose and need, the National Fire Plan, and the Healthy Forest Restoration Act. The action proposed by the Forest Service is to treat approximately 2,698 acres of forest lands by either thinning and/or pruning, hand piling and burning, jackpot burning, yarding tops, and/or understory burning to increase wildfire suppression effectiveness in and around the community of Orleans.

Hazardous fuels would be reduced along ridges and key locations adjacent to and within the Orleans Community. Surface and ladder fuels would be reduced to allow cultural burning and maintenance through prescribed fire. In a few areas only accessible by foot and adjacent to private property, surface and understory ladder fuels on federal lands would be cut and treated by hand, within a 300-foot buffer of the property line.

In addition, proposed vegetation treatments would reduce the density of understory, low- to mid-canopy-level and codominant trees, while promoting the development of large trees. Some canopy-level thinning would occur to promote the growth of mast-producing hardwoods and diverse forest structures. Canopy thinning by selective whole-tree removal would occur in a few select places to provide clear visibility from viewpoints associated with spiritual activities

Design Features

Design features have been developed to mitigate or reduce adverse impacts and achieve desired outcomes. These measures were guided by the direction in the Forest Plan, project-specific objectives, and concerns identified by the Forest Service and interested members of the public. Standards and guides from the Forest Plan that are applicable to the project are also listed. A full list of these features is provided in Appendix C.

Decision Framework

Based on the environmental analysis in the FEIS, the responsible official, Tyrone Kelley, Forest Supervisor will decide: (1) whether and how to reduce hazardous fuel accumulations on forest lands surrounding the community of Orleans; (2) how to enhance cultural values associated with the Panamnik World Renewal Ceremonial District; (3) how to reduce stand densities and maintain diverse stand structure and composition; (4) how to restore fire-adapted ecosystem functions; and (4) how to attain the desired vegetation characteristics of the Aquatic Conservation Strategy (ACS) objectives, in accordance with Forest Plan goals, objectives and desired future conditions. The responsible official will decide whether to implement the proposed action alternative, a modified action alternative, or the no action alternative. If an action alternative is selected, it will include:

- The location and design of the proposed vegetation treatment
- The location and design of the surface and ladder fuels removal
- An estimate of timber volume
- Access management measures including road construction and reconstruction, and area restrictions and closures
- Design features and monitoring requirements
- Disclosures during implementation to the collaborative group sponsored by the Fire Safe Council the location of any trees over 24 inches in DBH that are planned for removal, including removal associated with temporary road locations, corridors, and landings

Relationship to Forest Plan

The Forest Service has two levels of decisions: programmatic decisions, which create overarching direction such as the Forest Plan, and project-level decisions, which implement the Forest Plan. The OCFR FEIS is a project-level analysis; its scope is confined to addressing the relevant issues

and possible environmental consequences of the project. It does not attempt to address decisions made at a programmatic level.

The Forest Plan embodies the provisions of the National Forest Management Act of 1976, its implementing regulations, and other guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Six Rivers National Forest. Where appropriate, the OCFR FEIS also tiers to the Forest Plan Final Environmental Impact Statement (US Forest Service 1995c), as encouraged by 40 CFR 1502.20.

Forest Plan Management Areas

The Forest Plan uses management areas to guide management of the national forest lands within the Six Rivers National Forest. Each management area provides for a unique combination of activities, practices, and uses. The OCFR project area includes six management areas (Table 5). Goals, objectives, and desired conditions of each are summarized below. The Forest Plan (Chapter 4) contains a detailed description of each management area. The desired conditions identified for this project are consistent with those listed in the Forest Plan. Please note the acres in the Riparian Reserve and Recreational River management areas are encompassed within the other areas (i.e., acres are not additive). Also, acres in the project area, in general, are estimates as we continue to field review the units and edit our geographic information system (GIS) layers.

Table 5. Management area acres within the OCFR proposed action units

Matrix			Special Habitat	Riparian Reserves	Recreational River
General Forest	Partial Retention	Retention			
646	1,581	287	168	408	34

General Forest

This management area is intended to provide for multiple-use opportunities and a sustained yield of timber in a manner that preserves ecosystem function, biodiversity, and landscape integrity.

Partial Retention

This management area is located in the matrix. It is intended to provide an attractive, forested landscape where management activities remain visually subordinate to the character of the landscape. Direction is to manage for a programmed, sustained harvest of forest products in areas that are timber-suited.

Retention

This management area is located in the matrix. The primary goal is to maintain the area in a natural or near-natural appearing condition where human activities are subordinate to the character of the landscape and not evident to the casual forest visitor. Direction is to manage for a programmed, sustained harvest of forest products in areas that are timber-suited.

Special Habitat

This management area is intended to provide a core of relatively natural habitat for plants and animals associated with mature and old-growth forests. This management area within the project boundary includes protection for nest site protection zones and winter roosts for bald eagle and peregrine falcon.

Riparian Reserves

Under the ACS objectives, riparian reserves are used to maintain and restore riparian structures and functions of all streams, ponds and wetlands, confer benefits to riparian-dependent and associated species, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed. Riparian reserves are delineated during implementation of site-specific projects based on analysis of critical hillslope, riparian, and channel processes and features.

Public Involvement

Scoping

The Council on Environmental Quality (CEQ) defines scoping as "...an early and open process for determining the scope of issues to be addressed and for identifying the relevant issues related to a proposed action" (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the environmental analysis process. Although scoping is to begin early, it is really an iterative process that continues until a decision is made. In addition to the following specific activities, the OCFR project was listed on the Six Rivers National Forest Schedule of Proposed Actions (SOPA) as the "Sunset Fuelbreak Environmental Assessment" in January of 2006 (Winter 2006) and was later cancelled in July (Summer 2006). The OCFR project was then re-listed as a "new listing" in October of 2006 (Fall 2006) and has continued to be listed in each quarterly SOPA until present. To date, the public has been invited to participate in the project in the following ways.

Public Mailings, Meetings and Collaboration

On February 13, 2006, a letter providing information and seeking public comment was mailed to approximately 125 individuals and groups. This included federal and state agencies, Native American groups, municipal offices, businesses, interest groups, and individuals. A total of 27 responses to this mailing were received and 17 received at the Round Table Public Meeting during OCFR scoping, March 8, 2007.

Based on public feedback during scoping and seven public field trips, the Forest Service revised the proposed action and repeated the scoping process on October 19, 2007. A Notice of Intent (NOI) was published in the Federal Register on October 18, 2007. The NOI asked for public comment on the proposal from October 18 through November 19, 2007. A total of 30

responses to this mailing and publication were received. Thus, the Forest Service met with the Fire Safe Council, members of the community, the Karuk Tribe, industry and environmental group representatives to develop a collaborative alternative to carry forward into this FEIS under the Healthy Forest Restoration Act. The agency continued collaborative meetings organized by the Fire Safe Council in December of 2007 and early January 2008 (Figure 2). The alternative developed through this process is analyzed in this FEIS.

Figure 2. Collaborative discussions during a field trip

The use of new and existing roads for implementation of the proposed action, were discussed at length during open public meetings. The new temporary roads remaining as part of the proposed action are not considered to have significant impacts to the watershed. Stewardship contracting has also been the focus of several meetings and will continue to be throughout implementation of the proposed action. The economics of the project have also been considered and an analysis of the FEIS proposed action is included under Social Concerns – Economics.

An FEIS has been completed for this project at the request of several individuals that commented on the DEIS and earlier documents. The level of public interest justifies the completion of an FEIS versus an environmental assessment. A summary of concerns throughout the OCFR planning process is provided in Appendix E – DEIS comment analysis.

Tribal Governmental Consultation and Coordination

The Tribal government holds approximately 234 acres of land in the OCFR project area; approximately 40 acres are held in trust by the United States Government on behalf of the Tribe; the Tribe holds approximately 204 acres in fee status; and there is approximately 10 acres in three Indian Allotments owned by individuals (Appendix A - Map 4). The Forest Service holds a responsibility to consult for tribal interest related to lands that are held in trust by the United States government for the benefit of the Tribe to determine if a proposed action may potentially affect lands that are in trust, as well as to consult for other interests and concerns the Tribe may have with the proposal.

Consultation and collaboration with the Karuk Tribe regarding the OCFR project identified that the Tribe is concerned with the need to reduce wildfire risk to Tribal Trust Lands and Tribal property that may emanate from National Forest System lands. They are also concerned with Forest health within the overall project area and the need to provide for a myriad of cultural uses and long-term community safety. They also expressed concern regarding affects to the Panamnik World Renewal Ceremonial District, an eligible property to the National Register of Historic

Places, which is a culturally significant area for ceremonies and other activities. They are concerned about how the proposed project would be implemented; it is important to them to protect and enhance the culturally sensitive areas. The Tribe expressed the need for continued communication and collaboration throughout any implementation phase of the proposal.

Issues

After reviewing the responses to the proposed action, the Forest Service separates issues into two groups: significant issues and nonsignificant issues. Some issues were not considered because they were determined to be: (1) outside the scope of the proposed action; (2) already decided by law, regulation, Forest Plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. The Council for Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations requires this delineation in Sec.1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review…"

Appendix E consolidates comments received on the DEIS from the public and agencies and the Forest Service's responses. The Forest received 12 comment letters during the OCFR DEIS comment period, March 19 through May 13, 2008 (Appendix E, Table E-1). The content analysis is a compilation of comments from public scoping into a table format. In addition to comments, considerations and general comments were also captured. Economics was considered an important issue relative to the Forest's ability to garner funding to implement the proposed activities using a combination of harvest revenues, appropriated monies, grants, and cooperative agreements. For additional information regarding economics, please see the "Alternatives Considered" section in Chapter 2 and the "Social Consequences - Economics" section of Appendix E.

Chapter 2. No Action and Proposed Action Alternatives

This chapter describes and compares the alternatives considered by the Forest Service for the OCFR project. It includes a discussion of how alternatives were developed, an overview of design features, monitoring, a description and map, and a comparison of the alternatives that focuses on the ability of the alternatives to meet the purpose and need. Chapter 2 is intended to present the alternatives in comparative form, defining the concerns and providing a clear basis for choice among options by the responsible official and the public (40 CFR 1502.14).

Some of the information used to compare alternatives at the end of Chapter 2 is summarized from Chapter 3, “Environmental Consequences.” Chapter 3 contains the detailed scientific basis for establishing baselines and measuring the potential environmental consequences of each of the alternatives. For a full understanding of the effects of the alternatives, readers will need to consult Chapter 3 and supporting specialist reports, which are available at the Orleans Ranger District.

Alternatives Considered in Detail

Alternative 1 - No Action

The emphasis of this alternative is to disclose the effects of not accomplishing fuel reduction and forest health treatments in the OCFR project area at this time. It does not preclude activities occurring in another area or at some time in the future. The Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14d) requires that a "no action" alternative be analyzed. This alternative represents the existing and projected future condition against which the other alternatives are compared.

Vegetation and Fuels Treatments

Under the no action alternative, forest health improvements and fuels treatments would not occur, except in previously analyzed and approved project areas (e.g., Orleans CPPA and Hazel). Thus the no action alternative would provide job opportunities for completion of these activities implementing Priorities One and Two developed through the collaborative process and supported by Tribal and local communities. There would, however, be no prescribed burning, hand or mechanical thinning or mechanical removal or salvage beyond completing these ongoing and previously approved activities. The no action alternative would allow ecological processes to control vegetation development. Wildfires would continue to be suppressed in order to protect resources and property. If fire suppression continues to be successful, the no action alternative would allow vegetation to continue to grow more dense, thereby increasing the risk for high-intensity wildfires.

Access Management

Current access management activities would continue (e.g., maintenance, existing uses). The road decommissioning (2.7 miles) planned under the Orleans Transportation and Road Restoration Project (US Forest Service 2007) would occur.

Alternative 2 - Proposed Action

Fuel and Vegetation Treatments

The action proposed by the Forest Service is to treat approximately 2,698 acres of forest lands by either endline, ground-based, skyline, helicopter, or hand removal systems (Table 6; Appendix A - Maps 5, 6 and 7).

Table 6. Systems used to implement vegetation treatments by acres

Endline	75
Ground	789
Hand	1,404
Skyline	161
Helicopter	269
Total Acres	**2,698**

Hazardous fuels would be reduced along ridges and key locations adjacent to and within the Orleans Community. Surface and ladder fuels would be reduced to allow cultural burning and maintenance through prescribed fire. See Table 7 for the treatment breakdown. In a few areas only accessible by foot and adjacent to private property, surface and understory ladder fuels would be cut and treated by hand, within a 300-foot buffer of the property line. No commercial harvesting or road construction would occur in these areas.

In addition, proposed vegetation treatments would reduce the density of understory, low- to mid-canopy-level and codominant trees, while promoting the development of large trees. Some canopy-level thinning would occur to promote the growth of mast-producing hardwoods and diverse forest structures. Canopy thinning by selective whole-tree removal would also occur in a few select places to provide clear visibility from viewpoints associated with spiritual activities. A full list of treatments by unit is provided in Appendix B, as well as the marking guidelines for implementation of commercial thinnings.

Table 7. Fuel systems acres to reduce and remove surface and ladder fuels[1].

Thin/Prune	1,678
Hand Pile/Burn	1,383
Jackpot/Burn	586
Yard Top	1,098
Yard Under Material	187
Understory Burn	303
Pulling	521

[1] Some acres have more than one treatment type.

Sawlogs that are removed during treatments (an estimate of 7 million board feet of initial volume) would be sold as a by-product of the vegetation treatments.

In young forest stands that show the presence of black stain root disease (*Leptographium wageneri*), and others that are at high risk of infection, excess Douglas-fir trees would be carefully removed during summer months to reduce spread of this disease via insect and disease impacts. Douglas-fir trees with healthy crowns and undamaged boles that show no signs or symptoms of this disease would be retained at wide spacing, along with other conifer and hardwood species.

Some selective thinning in overstocked shrub, pole, and early mature stands within outer portions of riparian reserves would be accomplished through a combination of endlining and hand thinning. There would be no heavy equipment, stream crossings, or road activities in the riparian reserves. All treatments would promote ACS objectives, as defined by the Northwest Forest Plan (US Forest Service 1994). In old-growth stands, a minimum of 60 percent average canopy closure would be maintained after initial thinning and fuels treatments. No commercial harvest would be allowed.

Removal Methods

Potential fire impacts would be reduced in fuel reduction zones along key ridges and other key locations adjacent to and within the Orleans Community. Fuel generated through precommercial and commercial thinning or brush cutting would be disposed of by pile and/or jackpot burning or understory burning, chipping and/or removal off-site. Excess natural fuels would be treated similarly. A list of proposed fuels treatments by unit is given in Appendix B – Table B-1.

One or a combination of the following methods would be used to treat natural and treatment-generated fuels: (1) Hand piling and burning including cutting brush and small-diameter trees, limbing of green vegetation, and piling of this treated material along with dead and down fuels; (2) Jackpot burning, which is the covering and burning of fuel concentrations of natural and treatment-generated fuels; (3) Yarding tops of merchantable trees and piling at landings, tops of yarding corridors, or disposal areas for future treatment (such as biomass, firewood gathering or burning); (4) Yarding unutilized material out of treatment units; (5) Understory burning surface fuels and some ladder fuels under the canopy layer; (6) Pulling natural and activity-generated fuels away from residual trees or protected areas. Pulling from residual trees is generally in an approximate 6-foot circle to reduce impacts during understory burning. Pulling fuels from protected areas within a 25-foot radius from flagged trees (botanical) and away from identified cultural resource sites (used to prevent burn impacts); (7) Cutting and removing fuels, less than eight inches in diameter to landings or disposal areas; and (8) Creating handlines for control features during burning.

All units are planned to have an understory burn treatment, except for Unit 230. Some units may have an understory burn as the first treatment, while others may have an understory burn as a follow-up treatment within 3 years, within 3 to 6 years, or within 6 to 10 years. Most units have either a jackpot, hand pile or removal treatment as initial treatments to reduce ladder fuels and some surface fuels to allow understory burning to be used most effectively. Understory burning is planned to be used as a maintenance tool. Fuel treatments are planned to be effective under 90th percentile, or less, weather, which is typical August weather conditions.

Treetops, unutilized material, and cut and removed material would be decked on landings and/or disposal sites associated with each unit, or placed below roads at the tops of the skyline yarding corridors. If these areas are not large enough to accommodate the volume of material, other landings or disposal sites may be used. This material would either be used by the operator or made available to the public for firewood and biomass use for at least two years. After that

time, any remaining material would be burned. Any piles or decks on closed temporary roads would be burned as soon as they are cured.

Access Management

Access to the OCFR project area would be by a series of Humboldt County roads that exit to State Route 96 near the town of Orleans. These facilities are all weather-surfaced roads and are adequate for hauling timber.

The main Forest Service system roads that serve the project area are 15N01, 13N18, 11N11, and 10N13. Only 15N01 is a surfaced all-weather road capable of haul year round. The rest of these roads are surfaced, but only designed for haul outside of the wet weather season and would be subject to haul restrictions during wet weather.

All existing forest system roads needed for the project planning area were developed for previous product extraction. Some of these roads followed existing routes accessing early land development. Existing roads range in condition from meeting the objective maintenance standards they were designed for; to being partially closed due to lack of maintenance opportunities, or because they were placed in storage for future management needs. All roads would require routine or deferred maintenance for the proposed project activities.

The project is proposing to add two new roads and one road extension to the national forest road system. All of these have alignments that follow existing non-system roads. Because these roads are on existing road alignments, very little ground disturbance is anticipated. Construction activities are principally vegetation removal, road surface preparation, and erosion prevention in the form of waterbars and rolling dips.

The road extension is for forest road 10N13F and would extend the road approximately 350 feet. The extension would be built to match the existing road designs standards (OML 2, 14 feet wide, aggregate surface). The other two roads would be built to maintenance level 2 standards for project needs (timber hauling and stand management), and then reduced to maintenance level 1 for long-term storage until future management needs.

Figure 3. Reviewing temporary road locations with the public

The road access needs in the OCFR project area have been analyzed in the OCFR Road Analysis (US Forest Service 2008), which is hereby incorporated by reference. To implement this project and plan for future resource management needs, approximately 0.9 mile of road would be constructed on existing alignment and added to the forest road system (Table 8).

Approximately 2.7 miles of temporary roads would be constructed for this project (Figure 3). Of these, 1 mile would be constructed on undisturbed ground and 1.7 miles would be on existing alignment. One 0.5-mile existing temporary road, located in a riparian reserve, would be decommissioned. Under the Orleans Transportation and Road Restoration Project (US Forest Service 2007), an additional 2.7 miles would also be decommissioned in the OCFR project area boundary. All temporary roads created for the project would be located outside of riparian reserves and would be decommissioned after use. Temporary roads would not be rocked except where required on approaches to county roads for obtaining an encroachment permit.

Table 8. New system and temporary road miles required

New System Roads on Existing Alignment	0.9
System Road Total	**0.9**
New Temporary Roads on Undisturbed Ground	1.0
Reconstructed Temporary Roads on Existing Alignment	1.7
Temporary Road Total	**2.7**
Existing Temporary Roads to be Decommissioned	0.5
Additional Existing Temporary Roads to be Decommission in the watershed as a result of the Orleans Transportation and Road Restoration Project (US Forest Service 2007)	2.7

All aggregate requirements for this project can be met from existing sources on the forest or from commercial sources. All water requirements for this project can be met from existing sources on the forest or from the community services district. No new sources for water or aggregate would be developed. Dust abatement would be accomplished by using water.

Log landings would be used for skyline and tractor logging, and for decking and disposal of forest residues. Helicopter log landings and service landings would be used for helicopter logging (Table 9). Approximately, 15 new disposal sites and 38 new landings and/or disposal sites would be created. Approximately 94 existing landings may require minor earthwork to expand dimensions and minor clearing and/or blading. Landings would vary in size from one-quarter to two acres in size.

Table 9. Number of new and existing landings and disposal sites required

Type of Site	Acres of Site				Total Number
	0.25	0.5	1.0	2.0	
New Disposal Sites	14	1			15
Existing Disposal Sites	5				5
Existing Landings	79	13			92
New Landing and/or Disposal area	35	3			38
Helicopter Log Landing Site				5	5
Helicopter Service Landing			2		2
Grand Total	**133**	**17**	**2**	**5**	**157**

Lastly, hazard trees along the haul routes would be felled and removed during implementation of the project. Hazard trees felled within riparian reserves would remain on site except for portions of trees that fall within a road prism.

Implementation

Implementation of proposed activities would occur over the next five to 10 years as additional funds are secured and cooperative and community partnerships obtained. Funding for fuels maintenance cannot be guaranteed, however, cooperative measures would be explored to maximize the use of dollars available.

Forest Plan Consistency

All alternatives are consistent with the Six Rivers Forest Plan. All applicable forestwide and management area standards and guidelines have been incorporated. The Forest Service uses design features and preventive measures in the planning and implementation of land management activities. The application of these measures begins during the planning and design phases of a project. Additional direction comes from applicable Forest Service manuals and handbooks.

Project-specific Design Features

The analysis documented in this FEIS discloses the possible adverse and beneficial impacts that may occur from implementing the actions proposed under each alternative. Measures have been formulated to mitigate or reduce adverse impacts. These measures were guided by the direction from the Six Rivers Forest Plan.

Specialists use on-the-ground inventories, computer data (e.g., GIS and modeling results), and various studies to prepare their reports. Resource reports show the cause-and-effect relationships between the alternatives and their specific effects, and indicate design features to reduce or eliminate those adverse effects in the design of the alternatives. These reports are summarized and referenced in this FEIS. Resource concerns and design features may be refined further during final design work, when specialists have one more opportunity to revise their recommendations.

Applicable Forest Plan standards and guidelines, "Best Management Practices" (BMPs) used to meet the requirements of the Clean Water Act, and project-specific mitigation measures are identified in these reports. Appendix C includes a complete list of the project-specific measures.

Monitoring

Monitoring activities can be divided into Forest Plan monitoring and project-specific monitoring. The National Forest Management Act requires that National Forests monitor and evaluate their forest plans (36 CFR 219.11). Chapter 5 of the Forest Plan includes the monitoring and evaluation activities to be conducted as part of Forest Plan implementation. There are three

categories of Forest Plan monitoring: Implementation monitoring, effectiveness monitoring, and validation monitoring.

Due to lack of adequate funding, effectiveness and validation monitoring are not typically completed as part of project implementation. Implementation monitoring, and any additional project-specific monitoring, are however, important aspects of the project.

Multiparty Monitoring

The Healthy Forest Restoration Act contains provisions requiring that the Forest Service monitor the results of a representative sample of authorized hazardous-fuel-reduction projects and submit a report every five years that includes an evaluation of the progress toward project goals and recommendations for project modifications.

Section 102(g)(5) of the Healthy Forest Restoration Act instructs the Forest Service to establish a collaborative multiparty monitoring, evaluation, and accountability process when interest is expressed in such an approach. The process would be used to assess the positive or negative ecological and social effects of authorized fuel-reduction projects, as well as those undertaken under Section 404 (applied silvicultural assessments) of the Healthy Forest Restoration Act.

Diverse stakeholders, including interested citizens and Tribes, would be included in the monitoring and evaluation process. Multiparty monitoring would be an effective way to build trust and collaborate with local communities and diverse stakeholders, including interested citizens and Tribes. As contracts develop, we will continue to work with collaborators to establish priorities for implementation and monitoring.

Findings and Disclosures

Several of the laws and executive orders require project-specific findings or other disclosures. These findings and disclosures will be in the Record of Decision, which will document the decision and rationale made by the Forest Supervisor.

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare EISs concurrently with and integrated with …other environmental review laws and executive orders.” This project has been designed specifically with the following laws and executive orders in mind and is compliant with each under both the no action and proposed action alternatives:

- North Coast Unified Air Quality Management District Regulations
- Tribal Trust Property
- National Historic Preservation Act
- National Forest Management Act
- Management Indicator Species
- Endangered Species Act
- ACS objectives
- Northwest Forest Plan

- Magnuson-Stevens Fishery Conservation and Management Act,
- Clean Water Act, North Coast Basin Plan, Porter-Cologne Water Quality Control Act, applicable water quality control plans, Regional Board waiver (Order No. R1-20044-0015).
- Northwest Forest Plan Survey and Manage Species
- Wild and Scenic Rivers
- Environmental Justice

Alternatives Considered but Eliminated from Detailed Study

The NOI Proposed Action

The proposed action, released for scoping in the Notice of Intent published in the Federal Register October 12, 2007, was considered and evaluated in the spirit of the collaborative process as outlined by the Healthy Forest Restoration Act. Through meetings organized by the Fire Safe Council, revisions to the NOI proposed action were considered and agreed to. The revisions from the collaborative efforts are the FEIS proposed action.

Economics was considered an important issue and the NOI proposed action was reviewed for economic feasibility. Unfortunately, the economic feasibility of the project only improves slightly under the NOI proposed action and this alternative would not be acceptable to the majority of stake holders under the collaborative process. Therefore, this alternative will not be carried forward because components of the proposal did not meet the socio-watershed concerns of the community, including the Karuk Tribe and several special interest groups. The primary concern was the miles of new system and temporary roads proposed.

Under the Healthy Forest Restoration Act, an environmental assessment may proceed considering only the proposed action and no action alternatives if the proposed action alternative has been agreed to by the Fire Safe Council and collaborating partners and the project is entirely within the wildland-urban interface (WUI). In addition, Section 104 (2) of the Healthy Forest Restoration Act provision states that only two alternatives are required when the project is within 1.5 miles of a community at risk. No other significant issues have been identified and thus no other alternatives have been considered for this planning effort.

Comparison of Alternatives

A summary of how implementation of the no action and proposed action alternatives would meet the purpose and need of OCFR project is provided in Table 10. Information in the table is focused on indicators that can be distinguished quantitatively or qualitatively among alternatives. The supporting documentation and definitions of the indicators used are provided in Chapter 3 – Environmental and Social Consequences and in referenced Specialist Reports.

In general, under the no action alternative a higher probability of crown fires would continue throughout the project area. Fuels would continue to build, reducing the success of reintroducing

natural and prescribed fires. Under the proposed action alternative, more fire-resilient forests, with reduced hazardous fuel conditions, would be created. These conditions would support the reintroduction of fire-adapted ecosystem functions, including natural, cultural, and prescribed fire. Fuel reduction treatments would change fire behavior, so there would be lower intensity fires and less crown fire potential. These changes in fire behavior would also make roads safer for suppression access, for use as escape routes, and they would serve as effective anchor points for suppression activities. Over-all flame lengths in the project area would be reduced.

Under the no action alternative, restoration of a landscape supportive of cultural burning would not be created. The National Register eligible site, Panamnik World Renewal Ceremonial District, would not be protected from wildfire damage. Under the proposed action alternative, conditions that support cultural burning would be improved by lowering the density of surface and ladder fuels. In addition, clear visibility to important spiritually and culturally specific viewsheds would be provided. Cultural resources would be protected by project design features.

For spotted owl habitat, canopy closures of 60 percent would be maintained in suitable nesting/roosting habitat. This canopy closure would limit the ability to reduce stand densities; however, it does meet the purpose and need of reducing surface and ladder fuels while maintaining species habitats. Even in the commercial thinning units, where canopy closures may be reduced to 40 percent, the stand density index is predicted to maintain a desired density (below 60 percent) in the short term (until the year 2011). However, by the year 2031 the maximum percent is exceeded (71 percent). Thus, a 10 percent improvement over current conditions is maintained over time.

Riparian reserve treatments under the proposed action alternative would reduce the cumulative impacts of past management activities by accelerating the recovery of vegetation in plantations including the recruitment of large woody debris as well as providing 406 acres of more fire-resilient riparian reserves. The slight potential risk of sedimentation associated with fuel reduction treatments would outweigh the amount that could occur if there were a severe uncontrolled wildfire. Scientific references to support these conclusions are available in the Soils, Hydrology, Water Quality, Fisheries and Riparian Reserve Reports (Snavely 2008, Cook 2008, Cook and Cyr 2008).

A summary of anticipated resource effects from implementation of the no action and proposed action alternatives is given in Table 11 and at the end of each section in Chapter 3. No significant effects are anticipated.

Table 10. Anticipated ability of the no action and proposed action alternatives to meet the purpose and need of OCFR project

Reduce hazardous fuel accumulations on forest lands; Restore fire-adapted ecosystem functions	**No Action**	**Alternative 2 – Proposed Action**
Predicted Flame Lengths	42 – 82 feet	2 – 49 feet
Torching Index (wind speed needed to create crown fire)	12 – 20 mph	230 – 637 mph
Basal area mortality due to fire	93 to 100%	8 to 95%
Fire type rating (>3 predicts crown fire)	2.4 – 3.4	1.4 – 3.3
Enhance cultural values of Panamnik World Renewal Ceremonial District	No Action	Proposed Action
Number of acres suitable for cultural burning	Scattered areas are currently available	2,698 acres improved
Clear visibility attained at spiritual viewpoints	0	5 viewpoints improved
Improve forest health by reducing stand densities (recommended to be below 60% of maximum Stand Density Index)	**No Action**	**Proposed Action**
Stand Density Indices (% of maximum following initial treatments)	62 – 76%	33–43% Commercial 48–60% Noncommercial
Stand Density Indices (% of maximum approximately 20 years after the first treatment)	77 – 85%	52–54% Commercial 71% Noncommercial
Promote the development and maintenance of diverse stand structures and species composition	**No Action**	**Proposed Action**
Increase in average tree diameters (quadratic mean DBH in inches at year 2056; assumes only one thinning treatment at 2009 in the proposed action).	14.6 Noncommercial shrub/pole 16.2 Commercial shrub/pole 19.1 Noncommercial natural stands 20.2 Commercial natural stands	16.0 Noncommercial shrub/pole 18.7 Commercial shrub/pole 23.8 Noncommercial natural stands 29.4 Commercial natural stands
Maintain a healthy hardwood component (average % of total basal area in hardwoods at year 2056)	7-10	8 - 12
Accelerate development of resilient riparian reserves with late-seral characteristics	**No Action**	**Proposed Action**
Acres treated to reduce fuel accumulations	0	406
Acres of fire resiliency	90 rated as High	194 rated as High
Improved acres for LWD recruitment	0	166

Table 11. Anticipated effects of implementation of the no action and proposed action alternatives

Effects	No Action	Proposed Action
Air Quality	Could result in adverse air quality impacts from more severe wildfires	By reducing the occurrence of severe wildfires, this action could result in maintaining good air quality for this general area. Short-term minor impacts to air quality could occur during prescribed burning.
North Coast Unified Air Quality Management District Regulations	In compliance	In compliance
Tribal Trust Property	No significant effect	No significant effect
Compliance with National Historic Preservation Act	In compliance	In compliance
Carbon Emissions and Sequestration	Not analyzed	Increase anticipated
Short and Long Term Soil Productivity	Short and long-term soil productivity would be maintained.	Short and long-term soil productivity would be maintained. All unstable landslide areas are outside of unit boundaries and buffered.
Sediment Delivery to Streams	Wildfire which could potentially result in orders of magnitude of more sediment	The slight potential risk of sedimentation associated with fuel reduction treatments.
Attainment of AQS Objectives	Maintained and not further promoted	Would be promoted through reduction of fuel accumulation, increase in fire resiliency in riparian reserves, and increase in acres of LWD recruitment.
Critical Fish Habitat	Would not be adversely affected	The implementation of OCFR project activities as defined may affect and are not likely to adversely affect Southern Oregon/North California Coast coho salmon and their critical habitat.
Essential Fish Habitat	Would not be adversely affected	Project activities may affect Chinook salmon and coho salmon essential fish habitat, but would not adversely affect Chinook salmon and coho salmon essential fish habitat.
Aquatic MIS	Would not be adversely affected	Any minor sediment input resulting from the proposed action alternative is not anticipated to appreciably affect steelhead/rainbow trout or summer steelhead MIS due to their distance downstream of the project treatment areas. Aquatic habitat conditions for these subspecies are not likely to be adversely affected by implementation of the proposed action. The OCFR project would not adversely impact MIS or affect MIS fisheries viability
Forest Service Sensitive Species	Would not be adversely affected	For Forest Service sensitive species, the implementation of proposed action alternative may affect individuals but are not likely to trend towards Federal listing or loss of viability of steelhead or Chinook salmon. Riparian reserve treatments, in general, will have beneficial effects to Pacific salmonids and their habitat and will maintain or improve viability of these species.
North Coast Basin Plan	In compliance	In compliance

Table 11. Anticipated effects of implementation of the no action and proposed action alternatives

Effects	No Action	Proposed Action
Clean Water Act **Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board waiver (Order No. R1-20044-0015)**		
Wildlife Threatened, Endangered and Forest Service Sensitive Species, Neotropical Migratory Birds and Survey and Manage Species	This alternative would not remove or degrade any suitable habitat for any TES, MIS, NTM or S&M species; However, the no action alternative would not accelerate the development of late-successional habitat nor protect exiting late-successional habitat from stand replacing fires.	In critical habitat units and riparian reserves, and suitable TES habitat, the combined effect of the proposed actions (thinning, work in plantations, and establishing fuelbreaks and other fuel treatments) would result in a lower fire risk and hazard in the short-term, and an acceleration in the development of late-successional characteristics in current mid-mature stands in the long term.
Documented Sensitive Plant and Fungi Species	Early seral species such as Thermopsis robusta, which appear to require disturbance to germinate and grow, would remain stable in the short term. A sustained period without disturbance (natural or human-caused) may lead to local extirpations in the long-term and little opportunity for expansion of occurrences. Effects to other sensitive plants or fungi are not anticipated	With project design features in place, the proposed action alternative would not affect Buxbaumia viridis or Sulcaria badia. It is my determination that with the project design features, the OCFR project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for Ptilidium californicum, Thermopsis robusta, Boletus pulcherrimus, Dendrocollybia racemosa, Phaeocollybia olivaceae or Sowerbyella rhenana.
Survey-and-Manage Species Botany and Fauna	Habitat conditions would not change as a result of management activities, thus species at known sites would be expected to persist. An exception may apply to current habitat conditions at 3 sites of PTCA in two units subject to past thinning where the current condition provides for little immediate canopy cover.	No-disturbance buffers for botanical species as well as stand-level design features pertaining to maintenance of 60 percent canopy closure, retention of scattered hardwoods, shrubs ,logs and litter/duff across stands, would provide for persistence of survey-and-manage botanical and faunal species associated with OCFR. Habitat conditions for PTCA at 3 sites do not notably differ between the no action alternative and the proposed action. Design features at these sites aim to reduce the incidence of further changes in habitat conditions.
Noxious Weed Populations	If left unmanaged, the distribution of noxious weed populations would increase, with the lower watershed locations in the project area being the most vulnerable	Given the presence of noxious/invasive weeds within the project area, the habitat suitability of early-seral plantation, the complete vegetative clearing for new and existing landings, the use of helicopter and ground-based equipment on those landings, and activities on private lands, the risk of weed introduction and spread is considered high relative to these settings and activities. Project design features (Appendix C) have been incorporated into the project design to reduce the risk of introduction and spread of noxious weeds
Visual Quality Objective Standards	The landscapes being viewed have Moderate to High Scenic Integrity (meeting Partial Retention	Cumulatively, all project activities would meet their assigned VQOs. All viewsheds would remain natural or near-natural appearing and

Table 11. Anticipated effects of implementation of the no action and proposed action alternatives

Effects	No Action	Proposed Action
	to Retention VQOs cumulatively). As one moves through the area, the landscape appear slightly altered because of minor contrasts from old vegetative alterations which are growing back in.	appear visually subordinate to the characteristic landscape. Most units would not be visible from any inventoried sensitive viewpoint (i.e., Bark Shanty Road, Go Road, Ishi Pishi Road, Highway 96).
Wild and Scenic Rivers	Under both Alternatives Wild and Scenic River values including Free Flowing Conditions, Water Quality, and Outstandingly Remarkable Values would be maintained.	
Economics - Infrastructure	The loss of infrastructure and skills in the community to support vegetation management would further reduce the ability of a small community like Orleans to reduce the fire risk and at the same time provide economic and social well being of the community. In the long-term, recreation, organic farming, several small service type businesses, and other individual enterprises, which are mostly natural resource based or provide services to the local workforce benefiting from this work, would be still needed. The need for Roundtable Public Forums to maintain collaborative discussions and transparency of District management activities would lose momentum and restoration efforts by the District could suffer.	Infrastructure and skills to support vegetation management as proposed would be retained and expanded to contribute to economic growth and social well-being of the community. In 20 years, some commercial stands thinned as a result of implementation would be available again for commercial entry. Just as important, the desire of the community to share in responsibility for success of this project would continue to evolve and more partnerships and opportunities developed to use forest wood products available within the OCFR project area.
Economics – Viability	There would be no revenues or costs associated with this alternative	The Forest Service would not be able to sell the merchantable volume associated with this project under one timber sale due to the fact that purchaser costs associated with logging, hauling, road construction and decommissioning, purchaser fuel treatments, BD deposits, and road maintenance/surface replacement deposits exceed the value of the merchantable timber at the mill. The estimated value to the purchaser would be -$834,891. This is due, in part, to (1) a relatively low delivered log price for Douglas-fir (currently $375/MBF) and (2) the high costs associated with helicopter logging.
Environmental Justice	The no action alternative, by virtue of not creating any new work opportunities, could disproportionately adversely affect low-income and minority populations living in this river dominated remote areas within the Mid Klamath Basin.	There are no environmental justice concerns affecting human health or the environment that would have an adverse effect on minority or low-income populations through the implementation of the action alternative considered in this FEIS.
Short-term Uses and Long-term Productivity	No change anticipated under the no action alternative.	Under the proposed action, there would be a very short-term increase in fuel hazard in the period between thinning and activity fuel

Table 11. Anticipated effects of implementation of the no action and proposed action alternatives

Effects	No Action	Proposed Action
		treatment. This would be accompanied by a long-term increase in stand vigor, a reduction in fuel hazard, and a corresponding decrease in the risk of stand-replacing fire occurring within the harvest units. The use of temporary roads would provide improved efficiencies in cost-effectively providing timber products from those units where access needs warrant their use. Subsequent road decommissioning of these temporary roads would produce beneficial long-term effects to the beneficial uses of water from reduced sediment delivery into stream channels.
Unavoidable Adverse Effects	No change anticipated under the no action alternative.	The application of project design features is intended to further limit the extent, severity, and duration of potential effects. Regardless of the use of these measures, some adverse effects may occur.
Irreversible and Irretrievable Commitments of Resources	No change anticipated under the no action alternative.	The only irretrievable commitment of resources relative to the project under the proposed action alternative would be the use of approximately 500 cubic yards of aggregate from existing rock sources for routine road maintenance.

Chapter 3. Affected Environment, Environmental Consequences and Cumulative Effects by Resource

This chapter provides information concerning the affected environment of the OCFR project area, and potential environmental consequences to that area. It also presents the scientific and analytical basis for the comparison of the no action and proposed action alternatives presented in Chapter 2. All effects, including direct, indirect, and cumulative effects, are disclosed. Effects are quantified where possible.

The analysis to follow occurs at two scales, the watershed scale, and the stand/unit level of the proposed project. The proposed project falls within the LMK watershed. An analysis of the LMK watershed was completed in 2003 and it provides a general summary of the current vegetative conditions, including vegetation series, seral stage distributions, and potential risks of fire and health of vegetation and the ecosystem. Stand/unit level analyses will be summarized by broad groupings of similar seral stages and treatments.

Stand level analysis is based on data collected during extensive field exams completed in the summer of 2006 and 2007 and winter of 2007 and 2008. The Forest Vegetation Simulator (FVS) Growth and Yield model (version 6.21) with the Klamath Mountain Variant (revisions 11.8.2007 and 2.25.2008), were used to evaluate the effects of time and treatments on vegetation over the next 50 years. The Fire and Fuels Extension (FFE) of this model was used to predict potential fire behavior and fire effects to vegetation over the next 50 years. Fuels input, collected from field observations and use of Photo Series (PNW 105), were used to develop the fuel loading estimates. Duff depth, litter depth, continuity of fuels and type of vegetation were also collected for inputs into the FFE model. These inputs provided the existing conditions that were then used in the model to show results of fuel and silvicultural treatments. To simplify the display of analysis outputs, proposed treatment units have been broadly grouped according to seral stages, and whether they involve commercial thinning. There are four general groupings presented as follows:

- Shrub and pole seral stands without commercial thinning proposed
- Shrub and pole seral stands with commercial thinning proposed
- Natural stands (early mature and older) without commercial thinning proposed
- Natural stands (early mature and older) with commercial thinning proposed

It is important to point out that considerable variation occurs between the individual stands and units within each grouping specified above. This within-group variation is most significant in the shrub and pole stands without commercial thinning proposed. This group contains some units that were treated within the last five years for fuels reduction with light thinning from below, some that were aggressively released and thinned within the last five years without fuels

treatment, and many that have not been treated for quite some time and contain very high densities of trees.

There is also considerable variability within the natural stands groupings because some stands have been commercially thinned or selectively harvested in the past and others have not. Also, the assumptions about residual hardwood levels and fuel loads in proposed helicopter thinning units are different than those proposed for ground or skyline thinning. Therefore, when reviewing the analysis outputs for any of these groupings one should realize that the numbers are averages for the entire grouping and do not necessarily represent exact conditions for any particular stands.

Fuels and silviculture personnel prepared general prescriptions for treatments to meet the desired future conditions for the project area. The fuels prescriptions focus on reducing surface and ladder fuels while forest health prescriptions are intended to reduce stand density and promote species diversity, cultural values, and riparian reserve health. Generally, a combination of both fuels and forest health prescriptions occur on all units. Treatment methods include ground-based mechanical, endline, skyline, helicopter, and hand treatments. The selected methods are generally based on amount and sizes of fuel and vegetation to be treated, slopes, and road access. To minimize potential impacts to residual trees and to reduce amount of fuels left in units after harvest treatments, whole-tree yarding (i.e., tops of trees are also removed) would be used where possible. Cut-and-remove treatments could be accomplished by using mechanical, skyline, or endline equipment.

Treetops, unused material, and cut-and-removed material would be decked on landings and/or disposal sites associated with each unit, or placed below roads at the tops of the skyline yarding corridors. If these areas are not large enough to accommodate the volume of material, other landings or disposal sites may be used. Slash piles and decks left on landings or disposal sites after harvest has been completed, that are located on a drivable road, would be left for one to two years for possible firewood or biomass opportunities. After that time, any remaining material would be burned.

Analysis Documents Used For This Assessment

This FEIS is based upon analysis prepared in the following reports for the OCFR project and are hereby incorporated by reference:

- OCFR Project Silviculture Report (Graber 2008); OCFR Discussion of Project Impacts on Carbon Emissions and Sequestration (Salberg 2008); OCFR Project Fuels Report (Pfister 2008); OCFR Air Quality Report (Pfister 2008)
- OCFR Project Soils and Geology Report (Snavely 2008); OCFR Hydrology, Water Quality and Fisheries Assessment Report (Cook and Cyr 2008); OCFR Riparian Reserve Analysis (Cook 2008); Biological Assessment and Biological Evaluation for Threatened, Endangered, Proposed and Sensitive Fish Species that maybe affected by the OCFR project (Cyr 2008);
- Survey and Manage Report; and Biological Evaluation/Biological Assessment for Threatened, Endangered, Sensitive Wildlife Species for OCFR project (Schlick 2008);

- Matsutake Specialist Report; Noxious Weed Risk Assessment for OCFR project; Botanical Survey and Manage Report; and Biological Evaluation/Biological Assessment for Threatened, Endangered, Sensitive Plant and Fungi Species for OCFR project (Hoover 2008)
- Wild and Scenic Rivers Report (Talley 2008); Scenery/Recreation Report (Talley 2008); OCFR Road Analysis (Hann 2008); Transportation Report (Werner 2008); Economics Report (Rech 2008)

These reports are available at the Orleans Ranger District.

Past, Present, and Reasonably Foreseeable Actions

Appendix D, Tables D-1 and D-2 contain lists of past, present, and reasonably foreseeable projects considered for cumulative effects analyses on both forest lands and private lands. Past, present and foreseeable activities were derived from the Orleans Ranger District, and California Department of Forestry records. A map of cumulative effects boundaries used by resource specialists is provided in Appendix A - Map 8. Cumulative effects are bounded in space and time by resource.

Significant quantities of high-quality timber were harvested from the LMK watershed between the mid 1950s and the late 1980s. This harvesting was completed to replace older stands of poorly growing or sparsely stocked trees with well-stocked, even-aged stands of conifers. The vast majority of these stands were regenerated through the clearcut harvest logging system, which included site preparation by tractor piling or broadcast burning, followed by hand planting of conifer trees.

Since the late 1980s, timber harvesting in the analysis area has been limited to the periodic removal of roadside hazard trees. Harvest plans from the recent past (e.g., the Hazel Vegetation Management Project) focused on intermediate thinning treatments in 60 to 80 year-old stands rather than the regeneration of older stands. As the previously regenerated stands (plantations) approach the 30 and 40 year age classes, they also provide opportunities for commercial thinning treatments.

Environmental Consequences to Fire and Fuel Conditions

Goal: Reduce hazardous fuel accumulations on forest lands
: Restore fire-adapted ecosystem functions
: Enhance cultural values associated with the Panamnik World Renewal Ceremonial District through a reduction in fuels

Fire severity is a qualitative indicator (usually rated as high, moderate, low) of the effects of fire on an ecosystem, whether it affects the forest floor, canopy, or some other part of the system. Wildfires burning in areas of higher fuel loads, more ladder fuels, and uniform canopies generally increase adverse fire effects to the forest and adjacent communities and are more resistant to control by fire suppression forces. The main ignition sources for wildland fires are human and lightning-caused sources. “Regardless of the cause(s) of fire ignitions, *fuels remain the main*

contributor to a fire's environment (i.e., fuel, topography, and air mass) that humans can control or manage" (Countryman 1972 in Omi 2007).

The desired future condition of this project, after all fuel treatments, would be conditions that produce surface fire flame lengths less than four feet, resulting in less torching, reduced basal area mortality, and increased fire suppression effectiveness when a fire does occur within the project area. These conditions contribute to fire-resilient and resistant forests. Fire-resilient forests, with reduced hazardous fuel conditions, support the reintroduction of fire-adapted ecosystem functions, including natural, cultural, and prescribed fire in the forest.

% Basal Area Mortality

Percent Basal Area Mortality is the percent of the total basal area that would be killed under selected weather conditions (i.e., August for this exercise)

Affected Environment

The project is located on both sides of the Klamath River and extends out to key ridge features. Elevations range from 600 to 3,200 feet with all aspects present. Slopes range from 10 to 90 percent. The project area is generally low elevation with very warm summers and temperatures exceeding 105 degrees.

From late spring through the fall there are strong up-canyon winds that often exceed 20 miles per hour. The Windy Fire (approximately 0.7 mile south of Somes Bar on Highway 96) is an example of how high wind speeds can affect fire behavior in the project area. The fire started around 8:45 p.m. on July 27, 2000 and created spot fires over one mile away. When winds died down later that night, the fire spread slowed and fire crews were able to contain the fire later the next day, ending up at 70 acres. The Dance fire (2001) was also spread by high afternoon winds, with spot fires 0.25 to 0.5 miles down wind/ ahead of the fire. Timely arrival of retardant aircraft, lessening of winds, and a quick response from Forest Service fire crews, Orleans Volunteer Fire Department, and even local efforts helped to keep the fire from spreading more extensively into the community, and the fire was kept to 30 acres. There can also be very strong east winds which generally blow down-canyon during the fall.

The vegetation in the OCFR project area has begun "drying out" earlier in the summer than historically, resulting in a longer duration of very dry fuels and initiating the fire season earlier than usual.

The project area is 2,698 acres with approximately 1,010 acres in previously regenerated stands (plantations). These plantations range from 21 to 46 years old. Plantation characteristics range from heavily stocked large-diameter trees with minimal brush to heavily stocked with small-diameter conifers, tanoaks and brush.

Vegetation on National Forest lands within the project area is quite variable in terms of seral stage and species composition. However, with the exception of a few serpentine soil areas, the relative density of vegetation throughout the project area is high to extreme. Canopy closure is generally in excess of 90 percent. Within the shrub and pole seral stages, vegetation is typically a very dense single layer of brush species and small trees. Within the early and mid-mature seral stages, vegetation typically involves an upper canopy layer of hardwood and conifer trees with a

lower layer of remnant brush species and smaller trees. Within the late-mature and old-growth seral stages, vegetation is multi-layered with considerable horizontal and vertical structural diversity.

The predominant brush species in the project area include deer brush, manzanita, tanoak, madrone, and bay. The predominant hardwood trees include tanoak, Pacific madrone, Oregon white oak, California black oak, canyon live oak, and big leaf maple. Conifer trees include Douglas-fir, white-fir, ponderosa pine, sugar pine, and incense cedar. There are many pockets of down trees, both conifer and hardwood, due to heavy snowfall the last three years. These pockets range from approximately 0.10 acre to over one acre in size.

Surface fuels range from a light litter layer with occasional heavy fuel concentrations to moderate to heavy litter layer with more heavy, often continuous, fuel concentrations. A few areas have these same surface fuels but also have a grass layer included. Ladder fuels range from only scattered brush and small and moderate-diameter trees to large amounts of brush and small and moderate diameter trees that form a continuous layer from the surface fuels into the canopy. Canopy fuels range from widely scattered large trees to a dense canopy layer of large and moderate-diameter trees.

Site-specific fuel (i.e., fuel loading, litter and duff depth, fuel continuity) and vegetation data were used for running the Fire and Fuels Extension to the Forest Vegetation Simulator (FFE/FVS) program to produce more accurate unit-by-unit fire behavior predictions. The FFE/FVS links FVS with fire behavior, fire effects, and fuel loading models to simulate the effects of fire on forest structure and the effects of different treatments on fire potential. This program can help assess both the short- and long-term effects of fuel treatments and other management activities.

In the analysis below, a large increase in “torching index”, which is an indicator of the wind speed needed to initiate a crown fire, indicates that surface fuels and small ladder fuels have been reduced. The increase in crown base height also shows that the shorter ladder fuels have been treated effectively. A goal of treatments is to create conditions that result in a torching index that is greater than the typical August wind speeds (90th percentile). Treatment effectiveness comparisons are shown for the period after the 2011 treatments.

Torching Index

The wind speed needed to initiate crown fires. The higher the torching index, the more effective the fuel reduction treatment is.

Definitions of fire types come from the National Wildfire Coordinating Group (NWCG) Glossary of Wildland Fire Terminology, and include surface fire, passive crown fire, and active crown fire (Table 12). Numerical fire type is an output of FFE/FVS and is based on vegetation density and it is a good indicator of the effectiveness of fuel treatments.

Table 12. Fire type values and interpretations

	Fire Type	Values	Interpretation
Surface Fire	Low	< 2	A fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation
Passive Crown Fire	Moderate	2 –2.99	A fire in the crowns of trees with occasional torching of single trees and small groups of trees, ignited by the passing front of

			the fire. The torching trees reinforce the spread rate, but these fires are not basically different from surface fires.
Active Crown Fire	High	> 3	A fire in which a solid flame develops in the crowns of trees, but the surface and crown phases advance as a linked unit dependent on each other, most of the crowns are burning

Alternative 1 - No Action

Direct Effects

The FFE/FVS simulation runs, using 90th percentile weather conditions, in the shrub/pole commercial grouping predict:

- average flame lengths of 81.6 feet;
- average percent basal area mortality of 100 percent
- average torching index of 18.6 mph
- average fire type of 3.4, indicating an active crown fire.

Under the no action alternative, there would be no direct effects on torching index and fuel loading.

Indirect Effects

Under the no action alternative, fuel treatments would not occur and there would be no reduction in fire behavior (surface flame lengths) or fuel loading, and no change in fire suppression effectiveness. Impacts of wildfires to private property would likely increase and effectiveness of roads as safe evacuation routes or safe access for fire suppression forces would be reduced. There could also be increased impacts from fire suppression activities (e.g., more use of dozer lines as control features).

Conditions that contribute to fire-resilient forests, with reduced hazardous fuel conditions supportive to reintroduction of fire-adapted ecosystem functions, including natural, cultural, and prescribed fire in the forests, would not be enhanced. The impacts of trying to implement prescribed fire without fuel reduction treatments first, could likely result in unacceptable impacts to the project area (e.g., tree mortality, increased sedimentation in riparian reserves, increased smoke). Some prescribed fire could be implemented in areas where risk of impacts to stand is low.

Cumulative Effects

The cumulative effects boundary for fuels resources is the OCFR project area; the timeframe for analysis is 30 years in the past and 50 years forward. In the early 1980s, 1,614 acres were treated with prescribed fire. The effect of these treatments, however, is no longer evident. With no fuel reduction treatments, fuels would continue to build and contribute to increased impacts from wildfires and contribute to reducing the effectiveness of fire suppression efforts. There would be continued higher probability of crown fires throughout the project area. Fuels would continue to build, reducing the success of reintroducing natural and prescribed fires.

Alternative 2 - Proposed Action

Direct Effects

Under the proposed action alternative, there would be immediate effects to fire behavior and fuel loading. In noncommercial units, fuel treatments would reduce surface and low-level ladder fuels. In commercial units surface fuels, low-level ladder fuels and some mid-level ladder fuels, and some upper layer canopy would be reduced. Some fuel treatments would require future maintenance.

Indirect Effects

All hand units under the proposed action alternative would have at least a first treatment of thinning low ladder fuels (less than four inches DBH), piling of the cut material and hand piling of natural fuels (generally less than four inches DBH). All other units could have fuels less than six to eight inches DBH cut and removed, along with larger diameter material being thinned. All units would be planned for a future understory burn with the understory burning in noncommercial plantations occurring much later. The torching index would be the main indicator of success of treatments. Flame lengths could also be an indicator. The FFE/FVS simulations show flame lengths that would be the result from this type of fire. Passive crown fires have occasional torching that results in higher flame lengths than a surface fire. Active crown fires would generally have the highest flame lengths. Surface fire flame lengths are reduced in the proposed action, but do not show that they approach the desired future condition. Quite often, there is still some torching, which results in higher flame lengths, and is reflected in the simulations. The risk of large, high-intensity wildfires would be reduced and fire suppression effectiveness would increase. There would be less risk to private property. The effectiveness of using roads for evacuation routes would be increased along with safer access for fire suppression.

Implementation of the proposed action alternative would create average severe fire types of less than 3.0, except in shrub and pole noncommercial units, and after the year 2046 in shrub and pole commercial units. The desired torching index would also be met in all proposed action units (Figures 4, 5, 6 and 7). There would be increased opportunities for reintroducing natural and prescribed fire back into the ecosystem. There may be some associated risks during the implementation of prescribed burning, but this risk would be carefully assessed and mitigated as much as possible. A prescribed fire burn plan would be completed before ignition, which includes a risk analysis, as well as a “go-no-go checklist” (see Appendix B). With large areas of reduced fuel loading, suppression forces could, with more confidence of success, consider using roads and riparian areas for control features rather than dozer lines.

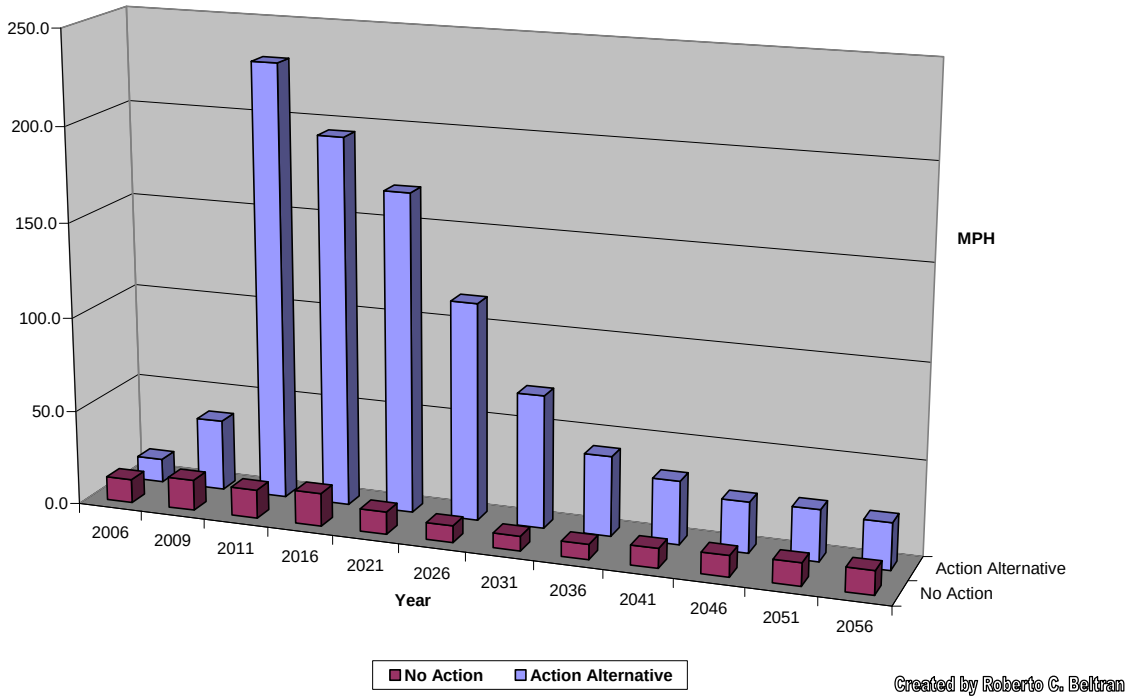

Figure 4. Torching index comparison of shrub and pole grouping with noncommercial treatment under the no action and proposed action alternatives at year 2011

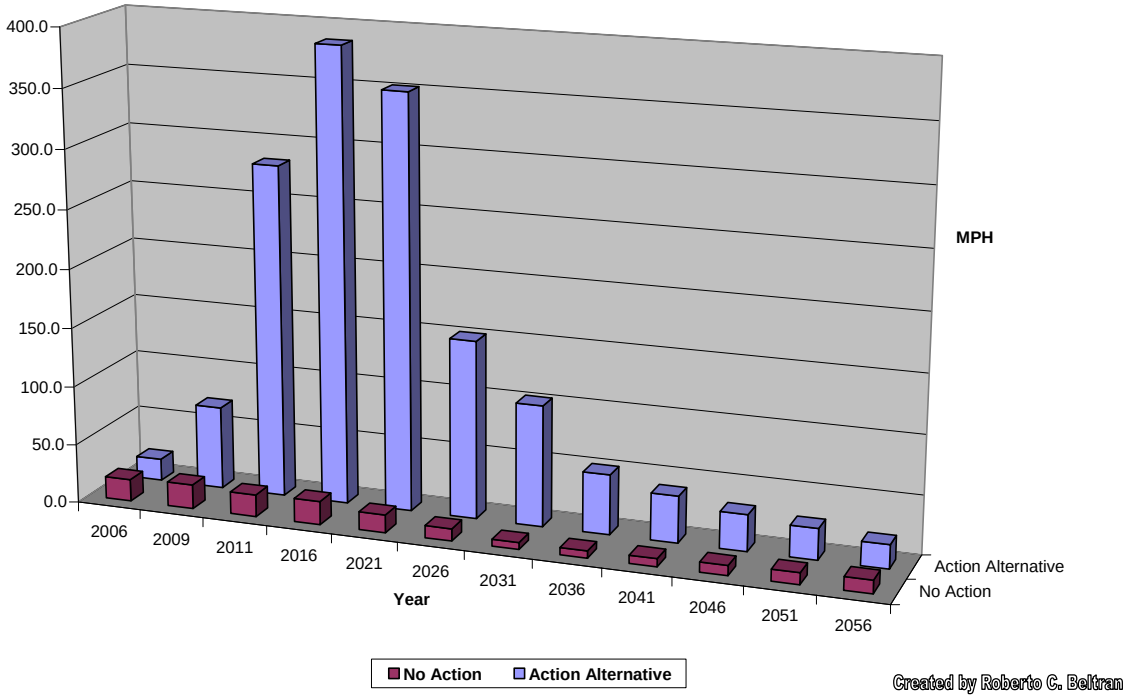

Figure 5. Torching index comparison of shrub and pole grouping with commercial treatment under the no action and proposed action alternatives at year 2011

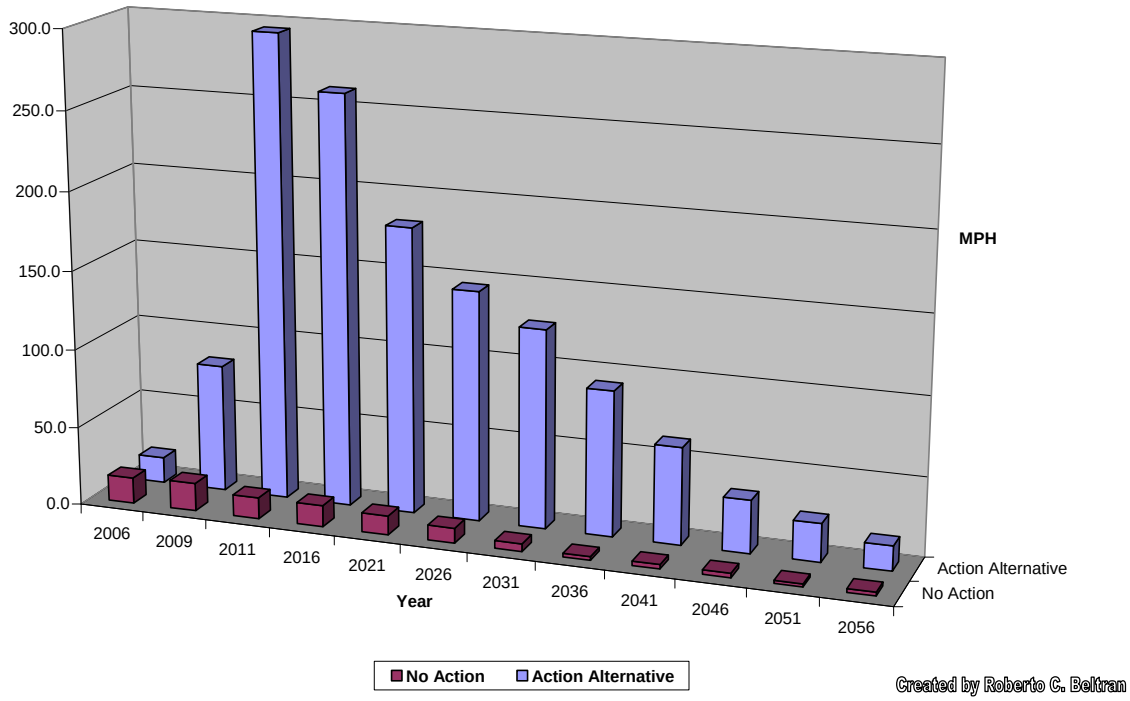

Figure 6. Torching index comparison of early mature and older grouping with noncommercial treatment under the no action and proposed action alternatives at year 2011

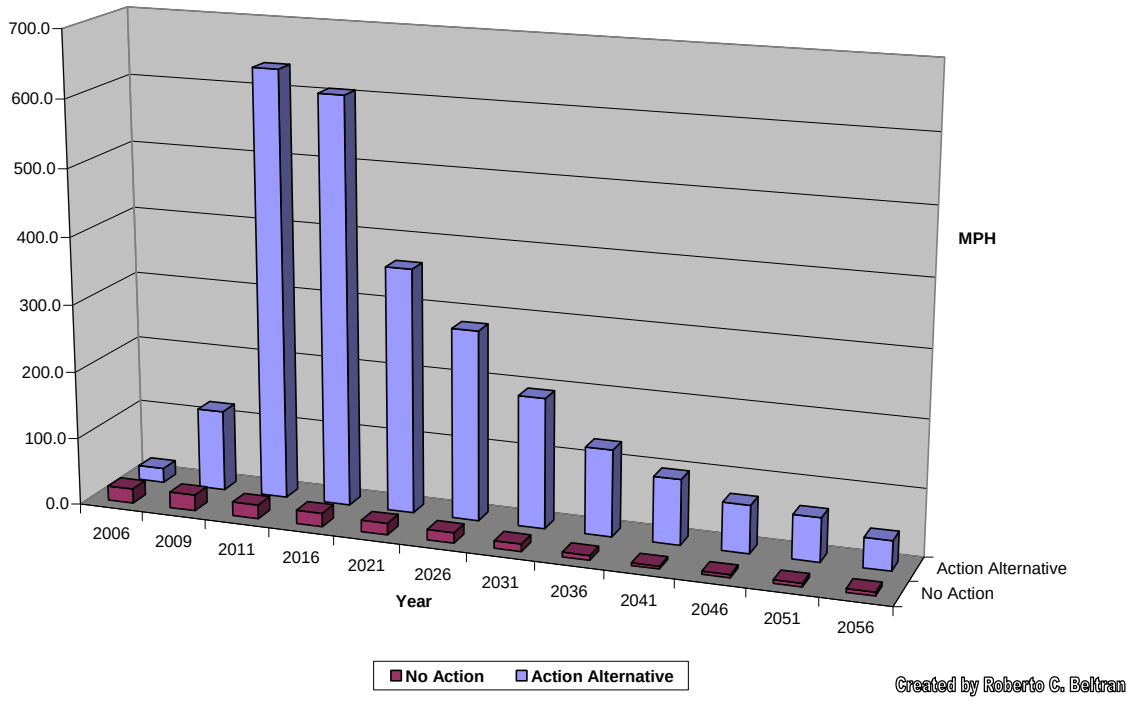

Figure 7. Torching index comparison of early mature and older grouping commercial treatment under the no action and proposed action alternatives at year 2011

Overall, the proposed action alternative is more effective in reducing the average flame length and basal area mortality than the no action alternative (Table 10, Figure 14 in Consequences to Vegetation below). Thinning and handpiling of the surface and low-level ladder fuels would reduce surface fire intensity and reduce some of the potential for crown fire initiation. Thinning of larger diameter, mid-level ladder fuels, along with some canopy reductions, would reduce torching and active crown fire potential. The mortality climbs to over 50 percent after year 2026 and flame lengths are reduced to between five and nine feet from years 2011 to 2016. The average torching index rises over 280 mph in year 2011 and does not drop below 30 mph until year 2046. Even though the models predicted extremely high wind speed needed to initiate crown fires, these wind speeds would likely never be reached, without catastrophic wind damage to the stands. Winds in excess of 100 mph would generally cause massive blowdown. We included these unlikely wind speeds because they showed that the treatments were very effective in reducing crown fire initiation, even if those wind speeds were not likely. The average fire type stays less than a 2.0 (surface fire) until after year 2021 and stays below a 3.0 (passive crown fire) until after year 2046.

In the shrub and pole commercial grouping, current conditions show severe weather average flame lengths at 81.6; average percent basal area mortality at 100 percent, average torching index is 18.6 mph; and average fire type is 3.4. Average basal area mortality increases to above 50 percent after 2021. The average fire type of less than two would be met until after 2031. Overall, the proposed action alternative in the shrub and pole commercial grouping is much more effective in reducing severe weather flame lengths; reducing basal area mortality; average torching index; and severe fire type than the no action alternative.

In the shrub and pole noncommercial grouping, Current conditions show severe weather average flame lengths at 67.5 feet; average percent basal area mortality at 97.6 percent; average torching index is 12.0 mph; and average fire type as 2.9. The desired torching index would be met until 2041 in shrub and pole noncommercial units. The average severe fire types of less than two would never be met in shrub and pole noncommercial units, with only one treatment as currently modeled.

Overall, if implementing only one treatment, the proposed action alternative in the shrub and pole noncommercial grouping is only slightly more effective in reducing average severe weather flame lengths and reducing average basal area mortality than the no action alternative. The average basal area mortality never drops below 90 percent. The proposed action is much more effective at increasing the average torching index. Conversely, the average torching index rises to over 230 mph in 2011 and does not drop below 25 mph until after 2051. None-the-less, the average fire type does not go below 3 (active crown fire) from 2009 on. However, results would improve by implementing multiple treatments in these youngest stands.

In early mature and older groupings with commercial treatments, current conditions show severe weather average flame lengths at 42.3 feet, average percent basal area mortality at 79.3 percent, average torching index at 21.4 mph, and average severe fire type 2.4. Overall, the proposed action alternative is more effective than the no action alternative in reducing flame

length and basal area mortality, increasing the torching index, and reducing severe fire type. The basal area mortality would increase above 50 percent by 2046.

Table 13. Fire behavior characteristics based on no action and proposed action alternatives in year 2011

Grouping	Average							
	Flame Length (ft)		Basal Area Mortality (%)		Torching Index (mph)		Fire Type	
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
Shrub/Pole Commercial	81.6	5.7	100	38.8	18.6	282.8	3.4	1.2
Shrub/Pole Noncommercial	67.5	48.6	97.6	94.5	12.4	230.4	2.9	3.3
Early Mature and Older Commercial Treatments	42.3	2.4	79.3	8.9	21.4	637.4	2.4	1.4
Early Mature and Older Noncommercial Treatments	54.8	28.0	93.3	45.8	16.3	295.2	2.4	2.0

In early mature and older groupings with noncommercial treatments, current conditions show severe weather average flame lengths at 54.8 feet; average percent basal area mortality at 93.3 percent, average torching index at 16.3 mph, and average severe fire type of 2.4. Overall, the proposed action alternative is more effective in reducing the average flame length than the no action alternative. The proposed action is more effective in reducing average basal area mortality than the no action alternative. In this grouping, the average torching index is 295.2 in year 2011. The proposed action alternative reduces surface and ladder fuels reducing severe fire type ratings to 2.4.

The proposed action alternative is more effective than the no action alternative for all four groups at reducing torching potential and basal area mortality. The torching index shows that both the commercial and noncommercial treatments of all four groups do reduce torching potential for at least 20 years. This torching index, along with an increase in canopy base height, indicates that flame lengths are reduced by the proposed action alternative. Basal area mortality is greatly reduced in the early mature and older commercial units and the shrub and pole commercial units. In the shrub and pole noncommercial groups, the basal area mortality is only slightly reduced. This is generally the result of not treating enough of the mid-layer ladder fuels and some of the upper layer canopy. The proposed action alternative is also more

The proposed action alternative is more effective than the no action alternative for all four groups in reducing torching potential and basal area mortality. The torching index shows that both the commercial and noncommercial treatments of all four groups do reduce torching potential for at least twenty years.

effective than the no action alternative at reducing fire type, except in the shrub and pole noncommercial groups. The proposed action alternative is generally more effective than the no action in all four groups except for the shrub and pole noncommercial units, whose results are very similar. Comparing fuel reduction treatments already implemented in Orleans CPPA Project to untreated areas shows that the reduction of surface and ladder fuels is an effective way to treat these fuels. These treatments would be monitored by field visits and predicted increases in fire behavior from the FVS/FFE model would be used to judge when maintenance treatments would be needed.

Cumulative Effects

Over time, as fuel treatments are implemented, the project would continue to reduce impacts from wildfires and increase fire suppression effectiveness. As fuel treatments are implemented, the project would continue to create conditions favorable for reintroduction of natural and prescribed fire. Except for the shrub and pole noncommercial units, and after year 2046 in the shrub and pole commercial units, favorable conditions could last out to 50 years. As fuel treatments are implemented, the units would then need to be considered for future maintenance treatments to continue to meet desired goals.

Fuels Maintenance

A concern regarding the lack of stand maintenance increasing fire behavior stems from implementation of commercial units, where open stands can be impacted by more exposure to the sun and increased wind speeds. In stands with increased exposure to the sun, surface fuels would dry faster, increasing the chance of ignition. Stump sprouting and brush regrowth could also increase. Increased wind speeds would not only dry fuels faster, but also increase the rate of spread of a wildfire.

These effects are not always the same across entire units and could occur in varying degrees, based on slope, aspect, and size and amount of trees left. Surface and ladder fuel treatments help reduce fire behavior and fire severity. Even if there are increased rates of spread, the wildfire severity would be reduced. Since all units would have surface and ladder fuel treatments, there would be less chance of crown fire initiation. There could be some stump sprouting, but mitigations to leave approximately two-thirds of largest existing sprouts would decrease the amount of new stump sprouts. Maintenance treatments are planned and efforts would be made to acquire funding from many sources (grants, appropriated funding, and from future stewardship projects). Even if it takes some time to get more funding for maintenance, the effectiveness of treatments would only start to decline after many years.

In noncommercial units, generally only low-level ladder fuels and surface fuels are reduced, while the mid-level ladder fuels and upper canopy fuels are not reduced. In these units, there would not be a large increase in exposure to the sun or increased wind speeds. There could be a small increase in brush regrowth and stump sprouting, which would not affect fire behavior.

For commercial units, indicators would be used to predict the timeframe needed for maintenance. For instance, when the average fire type exceeds “2.0”, which defines a passive

Conclusion: **Reduce hazardous fuel conditions on forest lands surrounding the community of Orleans to allow safe and effective fire suppression for fire-fighting crews in the event of wildfire. Promote restoration of fire-adapted ecosystem functions, such that when fire returns to the ecosystem, impacts are minimized**

- *Decrease probably flame lengths of potential fires under severe weather conditions to less than 4 feet and sustain these lengths over time;*
- *Increase the Torching Index (winds needed to create crown fires);*
- *Reduce basal area mortality due to fire; and*
- *Reduce the severe fire type rating (create conditions with a rating of less than three).*

- **No Action Alternative**: There would be continued higher probability of crown fires throughout the project area. Fuels would continue to build reducing the success of re-introducing natural and prescribed fires. Fire resilient forests, with reduced hazardous fuel conditions, supporting the re-introduction of fire-adapted ecosystem functions, including natural, cultural, and prescribed fire in the forests would not be created.
- **Proposed Action Alternative**:

1. Flame lengths would vary between 2 and 48 feet with implementation of the proposed action versus 42 to 82 under the no action alternative. Only the early mature and older commercial grouping would attain this goal of less the 4 foot flame lengths.
2. Torching index is increased remarkably, resulting in a severe fire type rating of less than 2 in all treatments except shrub and pole noncommercial.
3. Basal area mortality would decrease significantly in all groupings except shrub and pole noncommercial groupings (8 to 95% under proposed action versus 93 to 100% under the no action alternative). Except for shrub and pole noncommercial units and after year 2046 in the shrub and pole commercial units, favorable conditions could last out to 50 years. As fuel treatments are implemented, the units would then need to be considered for future maintenance treatments to continue to meet desired goals.
4. The proposed action alternative reduces surface and ladder fuels reducing severe fire type ratings to 2.4.

Concern: *Cumulative effects of past management have resulted in a lack of maintenance after project implementation and are a concern in the commercial stands where open stands can be impacted by increase sunlight and wind. In all commercial groupings, however, the severe fire type ratings never exceed 2 (potential for crown fire) in the foreseeable future for the early mature+ grouping and does not exceed 2 until year 2031 in the shrub and pole commercial grouping.*

crown fire, and when the torching index drops below 25 mph (which exceeds August wind speeds), maintenance needs would be identified and implemented as funds allow.

Environmental Consequences to Air Quality

Affected Environment

Alternative 1 - No Action

Direct, Indirect Effects and Cumulative Effects

There would be no direct effects to air quality from the no action alternative, because no prescribed fire would occur. Indirect effects would be increased fuel accumulations, combined with wildfires could produce large high intensity fires, which would negatively effect air quality. Cumulative effects would be the increased effects on air quality from larger amounts of smoke and longer lasting periods of smoke due to higher intensity wildfires from continued fuels build-up.

Alternative 2 – Proposed Action

Direct, Indirect and Cumulative Effects

There would be smoke produced from prescribed burning in the proposed action, however, all burns would be conducted in compliance with all North Coast Unified Air Quality Management District regulations. The decision to ignite prescribed fires depends upon environmental conditions being met. Weather factors and the appropriate amount of moisture are critical to achieving the desired effects. The Forest Service would monitor these elements and only ignite burns if the conditions are conducive to meeting the goals of the project. Smoke from these burns could, at times, impact people who live near a burning project; however, we would make every effort (including public notices) to minimize smoke impacts to the surrounding community.

Conclusion: **North Coast Unified Air Quality Management District Regulations**

- Implementation of the no action or proposed action alternative would comply with the North Coast Unified Air Quality Management District regulations.

Concern: *Smoke from these burns could, at times impact people who live near a burning project; however, every effort would be made (including public notices) to minimize smoke impacts to the surrounding community.*

Environmental Consequences to Cultural Resources

Goal: Enhance cultural values associated with the Panamnik World Renewal Ceremonial District

Affected Environment

The OCFR project area lies within the cultural sphere of influence of the Karuk village of Panamnik in the Mid Klamath Watershed, where culturally and spiritually significant World Renewal Ceremonies are held in September. The World Renewal Ceremonial system is an integral part of the social fabric that links the Indigenous people of the Klamath River into a cohesive social system, which is still intact today. The families of the Panamnik, as well as numerous other tribal members and even members of other neighboring tribal groups, continue to utilize the cultural and natural resources throughout the OCFR project area. There are many undisclosed sacred sites, gathering sites, gathering areas, hunting areas and fishing spots as well as prehistoric, historic and contemporary use areas throughout the landscape. Tribal people in the area continue to practice a close relationship with the land and value many resources there as sacred. The landscape of natural and cultural resources (natively viewed as one, without distinction) has continued to be occupied and traditionally used. One of the more dynamic ways in which the Karuk have influenced and managed the landscape within the OCFR project area was through the use of fire. In fact, the contemporary landscape around the Orleans Ranger District has anthropogenic origins (Busam 2006:125).

The southern zone of the proposed action alternative would take place within the Panamnik World Renewal Ceremonial District, which is determined eligible for the National Register of Historic Places. To the Karuk people, this culturally significant and sensitive area provides

opportunities for hunting and gathering. The area has archeological and ethnographic significance as well as spiritual and ceremonial importance. Cultural resources consist of a landscape with a ceremonial trail, prehistoric and historic trail systems, and areas of traditional use for hunting and gathering.

For the proposed action alternative, 1,692 acres were surveyed during 2007 and 2008, for inventory of cultural resources within the project area. The survey strategy included both intensive and reconnaissance level surveys, depending on extent of ground disturbance anticipated from project activities. To date, 20 cultural sites have been recorded, the largest being 125 acres in size. In addition, a large piece of one cultural district (600 acres) lies within the cultural resources cumulative affects boundaries – or area of potential effect (APE). Additional inventories would be completed during project implementation.

Alternative 1 - No Action

Direct and Indirect Effects

Under the no action alternative, the restoration of conditions supportive of cultural burning would not be created. The National Register eligible site, Panamnik World Renewal Ceremonial District, would not be protected from wildfire damage or fire suppression activities, and Karuk cultural values would not be enhanced. Indigenous environmental management practices inherently sustain biodiversity by working more closely with ecological processes and fostering habitat complexity, which maintains populations of Culturally Traditional Ceremonial Species including both flora and fauna by enhancing the productivity of the forest, grassland, and aquatic ecosystems.

Hardwood restoration in early to mid-seral stands would not be accomplished. Removal of specific trees identified by the Karuk Tribe to enhance the experience of spiritual practitioners by exposing certain viewsheds would not occur.

In all, 2,698 acres of fuels reduction would not occur in the first decade as proposed. The Orleans Community would remain at risk from catastrophic wildfire and cultural burning would not take place because of the high fuel loadings that would persist overtime.

The buildup of fuels has offered a certain amount of protection for some cultural sites by covering them and limiting vandalism and soil erosion. In addition, preservation of the two significant historic mining sites would be enhanced. However, vegetative growth and decay that may be causing site damage would not be ameliorated.

Cumulative Effects

The cumulative effects boundary for cultural resources is the OCFR project area. The timeframe for effects is 30 years previous and 10 years into the future. A list of projects considered for effects is given in Appendix D. Prior to the cessation of cultural burning activities in the early 1900s these areas were comprised primarily of scattered larger-diameter conifers with a healthy hardwood layer beneath and relatively little understory vegetation. The regular use of fire prevented most young trees from becoming established in the understory. Fire also served as a tool to thin out the weakest or thinnest barked trees from the clumps of younger age classes. Fire

was very effective in maintaining and enhancing the quality of a wide variety of culturally important plants for food, basketry, and spiritual uses of the Karuk people. Under the no action alternative, these cultural values would continue to decline.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The commercial treatment of approximately 1,294 acres under the proposed action would prepare the landscape such that prescribed fire could be used to maintain these stands overtime. Hardwood restoration would also support ongoing cultural use of these areas by the Karuk Tribe.

Spiritual and cultural viewsheds would be created by the cutting of certain trees proposed specifically by the Karuk Tribe during consultation. In all, approximately 2,698 acres of fuels reduction would occur in the first decade funding permitted.

To reduce the potential or magnitude of direct effects associated with implementation of the proposed action alternative, standard resource protection measures would be applied (see Appendix C). In protecting cultural resources within the project APE, the Region 5 Programmatic Agreement has recommended specific protective measures. In general, flagging sites or modifying project boundaries to avoid impacts is effective and would be used.

Under the proposed action alternative, segments of one significant mining ditch would be directly impacted. A second, significant historic ditch would not be directly impacted. A repair plan has been designed for the significant mining ditch and will be submitted to State Historic Preservation Office (SHPO) regarding this site. Monitoring of several specific archeological sites during project activities has also been recommended.

There is a possibility of inadvertent damage to unrecorded subsurface cultural sites during ground disturbances. These would be reported to SHPO, and the Karuk Tribe would also be consulted.

Removal of fuels material would have both a positive direct effect and a negative indirect effect. Directly, sites would benefit from removal of encroaching, and possibly damaging, vegetation, however, the sites may then become visible and more exposed to vandalism. Some site-specific decisions would be made regarding site protection during and after fuel removal.

Cumulative Effects

The effects of commercial thinning on stand and tree growth, degree of logging damage, and dead fuel buildup have been observed locally since the early 1970s. Prescribed fire has been used locally in forest situations for site preparation and fuels reduction since the early 1960s.

A segment of a historic trail was observed and earlier recorded, but due to natural deterioration, the trail has been determined to be *non-significant* and would not be protected from project activities. Two other historic trails run through the project area, but do not meet the criteria for inclusion to the National Register and have both been damaged by previous road construction, timber harvesting, and natural attrition. They would not be protected through the National Historic Preservation Act (NHPA); however, project design features would protect them during project activities (Appendix C). After consultation with Karuk spiritual practitioners, it

was determined that a Karuk spiritual trail, would not be negatively impacted by either the no action or proposed action alternatives.

Under the proposed action alternative, conditions that support cultural burning would be restored by lowering the density of surface and ladder fuels that currently prohibit practice. Clear visibility to important spiritually and culturally specific viewsheds would be provided. With the combination of commercial and precommercial thinning, fuels reduction, and the reintroduction of low to moderate-intensity understory burning, it is anticipated that within the first decade of initiating treatments many culturally important plant species would be enhanced in terms of quality and quantity available.

Conclusion: Enhance cultural values associated with the Panamnik World Renewal Ceremonial District through improved forest health and a reduction of fuels:

- *Increase the acres of vegetation available for maintenance through cultural burning*
- *Open the vistas from five viewpoints on the ridge-tops to significant viewsheds..*

- **No Action Alternative**: Additional acres for cultural burning would not be created. Pre-treatment, i.e. a reduction of present surface and ladder fuels is needed to allow maintenance through prescribed fire..
- **Proposed Action Alternative**: Conditions that support cultural burning would be enhanced by lowering the density of surface and ladder fuels that currently prohibit burning. In addition, clear visibility to important spiritually and culturally specific viewsheds would be provided (refer to Environmental Consequences to Vegetation Resources for additional information).

Concern: *Cultural resources are required to be protected by project design features given in Appendix C under the proposed action alternative.*

Other Disclosures for Cultural Resources

Tribal Trust Property

The Karuk Tribe of California has interest in lands it owns that are held in trust by the Federal Government on behalf of the Tribe, as well as fee lands held by the Tribe, and in three Indian Allotments held in trust by the Federal Government on behalf of individuals within the area of Orleans. Formal government-to-government consultation and collaboration has been conducted with the Tribe to identify and address effects to Tribal trust lands and other issues and concerns. With the implementation of this project, there would be a reduction of risk from wildland fire emanating from National Forest System lands due to the reduction of fuels within the project area. Therefore, there would be no significant direct effect on or conflict with Indian Allotment, Tribal trust or fee lands due to this project.

Compliance with the National Historic Preservation Act

The NHPA requires protection of all significant cultural resources, including archeological sites. In compliance with the Region 5 Programmatic Agreement[1] and interim protocol[2] with the SHPO

[1] The First Amended Regional Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region, California State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region

for the process of Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region, historic and prehistoric cultural sites have been identified and protected.

An archaeological reconnaissance was conducted on the project area and recorded in a Cultural Resource Inventory Report (CRIR 05-10-989), which is on file in the Heritage Department of the Six Rivers National Forest Supervisor's Office. Standard resource protection measures have been applied to those sites in and near the area of potential effect. The alternatives considered would have SHPO approved affects on a historic mining site and no affects to other districts or sites listed in, or eligible for listing in, the National Register of Historic Places.

In areas where fuels reduction activities would be applied exclusively, the Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects, a 2004 Annex to the above Regional PA, would be used to complete the Section 106 process in those areas. This document allows for post clearing survey, when the ground would be visible for cultural survey.

Several historic sites within the project area have been evaluated for significance to determine if protection is needed. Presently, a Determination of Evaluation (DOE) has been undertaken for three of the sites. Two historic mining sites were Determined Eligible and one historic site was Determined Ineligible. These DOEs were submitted to SHPO for concurrence. Project work has been proposed within the site boundaries of one significant historic mining site. A plan to protect the site during project implementation, with a design for repair to damage, has been submitted to SHPO. Another site, a previously recorded scatter of stone tools and groundstones, was damaged after being initially recorded in the 1970s, during an earlier management action in 1987. The site lost most of its site integrity and although a Site Damage Report was made in 1987, the site would have to be reevaluated for significance. The Forest would work with the Tribe regarding any mitigation needed to avoid further damage to what remains of this site. Other site record updates would be completed to facilitate future relocations of the sites for monitoring during project activities. Except for fuels reduction activities, acorn gathering oak trees and cultural gathering areas would be avoided during project implementation. Culturally valued viewsheds, important to ceremonial activities, would be enhanced through removal of surface and ladder fuels. Restoration of cultural burning used to maintain the forest hardwood component, as historically practiced, is the desirable future condition.

[2] Interim Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects Annex to Stipulation IX in the First Amended Regional Programmatic Agreement among the USDA Forest Service, Pacific Southwest Region California State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region

Conclusion: Compliance with National Historic Preservation Act

No Action or Proposed Action Alternatives:

- There would be no significant direct effect on or conflict with Indian Allotment, Tribal trust or fee lands due to implementation.
- Both alternatives would be compliant with the National Historic Preservation Act.

Environmental Consequences to Vegetation Resources

Goal: Improve forest health by reducing stand densities and promoting the development and maintenance of diverse stand structures and species composition

To assess relative densities of trees, currently and through time, the stand density index (SDI) outputs of FVS are used. The percentages of maximum potential SDI as the indicator of relative stand density were calculated. The SDI is an expression of the relationship between the average size, as defined by the quadratic mean diameter, and number of trees per unit area. This relationship between average size and density of trees in stands experiencing density-related or suppression mortality has been shown to be very predictable. This fundamental relationship, independent of both stand age and site quality, provides a basis to display the competitive interactions between individuals in a population. In general terms; 25 percent of maximum SDI roughly corresponds to the on-set of competition between individuals in a stand and the lower limit of self pruning; 35 percent of maximum SDI corresponds to the lower limit of "full site occupancy"; 60 percent of maximum SDI corresponds to the lower limit of self-thinning, where suppression induced mortality becomes significant (Long 1985).

Stand Density Index

The SDI is an expression of the relationship between the average size (as defined by the quadratic mean diameter) and number of trees per unit area.

Affected Environment

Vegetation within proposed treatment units is almost exclusively of the tanoak or Douglas-fir vegetation series, with the vast majority occurring in the tanoak series. There are also a few small serpentine barrens in the central part of the project near Black Mountain.

Seral stage distribution within proposed treatment units, like that of the LMK watershed, is primarily the result of disturbances from fire, flooding, mass wasting, and clearcut regeneration harvesting. Existing seral stages within proposed units, based on 1990 classifications, include approximately; 1,010 acres of plantation including 566 acres of shrub (21 percent) and 444 acres of pole (16 percent); 351 acres of early mature (13 percent); 784 acres of mid mature (29 percent); 505 acres of late mature (19 percent); and 41 acres of old growth (two percent). All except five acres of the shrub stage, and all of the pole stage, are the result of previous regeneration harvesting. Previous selective harvesting has modified vegetative structure but not changed the seral stage classification on approximately 540 acres of early mature, mid mature, and late mature stands.

Currently, the LMK watershed supports approximately eight percent of its area in the shrub/forb seral stage, eight percent in the pole stage, 29 percent in early-mature, 25 percent in mid-mature, 15 percent in late-mature, and 15 percent in old-growth. At the watershed level, for both the north and central ecological zones, only the old-growth seral stage of the tanoak and Douglas-fir series is below the recommended management range for sustaining healthy ecosystems (LMK Watershed Analysis 2003). However, if there was an established recommended management range for the shrub and pole seral stages, it would likely indicate that the LMK watershed is a little low in these categories to ensure a long-term future quantity of mature and older seral stages. The early, mid, and late mature stages are currently at or above the recommended level.

With the cessation of Karuk cultural burning and the suppression of natural fires during the last 100+ years, the normal disturbance regime for this fire-adapted ecosystem has been significantly altered. What was once a regime of frequent low-intensity fires and occasional high-intensity fires following extended drought periods has become a regime of relatively infrequent, high or variable-intensity fires. With a significantly increased time period between fire disturbances, many trees have been able to become established and encroach into the canopy layer whereas most of them would have been thinned or eliminated under the previous regular fire disturbance regime. Therefore, the overall density of trees within the project area, and the LMK watershed, is much greater now than it was prior to 100 years ago.

Based on reviews of historic aerial photographs, communications with tribal representatives, and evidence in the field of previous stand conditions, and literature, stand and landscape level conditions have changed considerably over the last century. In very general terms, relatively open canopies of large hardwoods and scattered conifers have now developed into consistently dense canopies containing a far greater proportion of Douglas-fir trees and significantly fewer mast producing hardwoods. The previous relatively open patchwork or mosaic of younger age classes and diverse species in the understory has given way to a relatively consistent layer of small and medium Douglas-fir and tanoak trees with fewer species of plants present.

In the interest of improving stand and forest health, increasing resiliency to disturbances or stressors such as weather extremes and gradual global warming, and to enhance the availability and quality of traditionally gathered plant materials, it is desirable to restore significant portions of the landscape back towards prehistoric conditions. However, for most stands in this project area and the larger watershed, such a transition would require considerable manipulation to remove excess trees from all layers of the stands and to prepare the sites for the reintroduction of a regular low-intensity fire disturbance regime.

The combined effects of extended time periods between fire intervals and significantly increased tree densities, with the resulting reduction of light penetrating into and through the canopies over time, has lead to a gradual shift in vegetative composition. For almost all natural stands (early mature and older) in the proposed project and the watershed, those species of trees and shrubs which are tolerant or moderately tolerant of shade, such as tanoak, incense cedar, and Douglas-fir, have increased their numbers in proportion to less tolerant species such as pacific

madrone, ponderosa pine, and the true oak species. Additionally, the quantity and quality of many traditionally gathered plants or plant parts has been significantly reduced, due to both the decreased amounts of light available and the lack of regular low-intensity fire disturbance.

The prehistoric fire disturbance regime not only served to regularly reduce the density of forest stands, especially in the smaller diameter classes, and keep fuel loads in check, but also resulted in a mosaic pattern of vegetation patches, which provided structural and species diversity to the landscape. With the significant levels of encroachment and increased vegetation density that has occurred over the last 100 + years, overall landscape complexity has been somewhat reduced.

Please note, because Douglas-fir is the primary, and almost exclusive, conifer species present in proposed treatment units, there is little concern about bark beetle (*Dendroctonus pseudotsugae*) caused mortality beyond endemic levels, regardless of stand densities (Angwin 2007; Tappeiner, , Maguire, and Harrington 2007). Therefore, there would be no direct, indirect, or cumulative effects related to bark beetle mortality associated with this project and it will not be addressed further.

Wood borers (*Melanophila* spp.) have been active within the project area and watershed for quite some time. These insects are considered secondary insects that attack weakened or dead trees. They can be locally important, generally reducing the growth of seedlings and saplings and killing larger trees weakened by other causes, such as extended moisture stress from drought or overly dense stocking, root diseases, sun scald, fire, wind/snow damage, etc.

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Under this alternative, it is assumed that no additional management activities would occur within proposed treatment units. No direct effects would result. Indirect and cumulative effects are discussed below.

Reduce Stand Densities

With currently high stand densities throughout the project area comes increased susceptibility to damage and mortality resulting from such stressors as drought, fire, insects, and diseases. Many trees are currently experiencing high levels of competition for soil moisture, nutrients, and available light. Natural thinning is occurring to some degree in almost every unit of the proposed project, and additional stressors can trigger pulses of significantly increased mortality. Figure 8 through Figure 11, displayed under the proposed action alternative below, display the change in percentage of maximum SDI over the next 50 years as a result of natural thinning mortality, barring major disturbance events.

In general, the vast majority of proposed treatment units would continue to experience high rates of mortality and natural pruning well into the future, or until a major disturbance event reduces stocking to a much lower level. Because most of the LMK watershed is in similar seral stages and stand conditions, the risk of high rates of mortality and the associated fuel buildup is widespread (more detailed figures are available in the Silvicultural Report (Graber 2008)).

As natural thinning and pruning occurs, standing and fallen dead fuels are created. At high levels of mortality, the accumulation of such fuels can be very significant. One important factor for the future health of these stands is their ability to withstand the effects of fire. Figure 12 through Figure 15 (proposed action alternative below), display the percentage of total stand basal area that would be lost if a potential fire occurred under severe (90th percentile) fire weather conditions.

If an uncontrolled fire occurred in the near future under severe fire weather conditions greater than 80 percent of the total basal area throughout the project units would likely be killed. And without intervening treatments, this potential level of mortality from fire generally increases with time. This same observation would be true for the vast majority of stands within the LMK watershed. Should such a fire occur prior to treating large areas of the landscape it would likely result in a significant increase in the size of future openings and resulting stands.

Increase Average Tree Diameter and Maintain Healthy Hardwood Component

Existing and future average tree diameters (quadratic mean DBH in inches) for the stands in each grouping are displayed under the proposed action alternative below (Table 14). In general, the quadratic mean DBH in inches would double for the shrub and pole grouping in both the noncommercial and commercial groupings if no treatments or major disturbances occurred over the next 50 years. The quadratic mean DBH in inches would increase almost 30 percent in the early mature and older groupings.

Existing structural diversity within proposed treatment units, and at the watershed level, has been reduced by the considerable encroachment of Douglas-fir trees into and through the canopy of most stands, and an increase of Douglas-fir and tanoak trees in the understory and lower canopy of most stands. Because conifers generally grow to greater heights than local hardwood species, the majority of hardwood trees in proposed treatment units are now being overtopped except in the youngest shrub and pole stands and in plant aggregations that do not contain many conifers.

Without treatments, existing and future levels of average hardwood stocking, as indicated by the percent of hardwood basal area relative to total stand basal area, would be as displayed in Table 15 (p. 57). Without regular thinning of encroaching conifers, the proportion of hardwood basal area in treatment units, and within the larger LMK watershed, would continue to fall.

With continued increases in the proportion of Douglas-fir trees across the landscape, and the associated reduction in the proportion of healthy hardwood trees, combined with the general loss of vertical and horizontal structural diversity, the proposed treatment units and the LMK watershed would become less resilient and even more vulnerable to significant adverse effects from disturbances and environmental stressors.

Due to the high stocking levels within most shrub and pole stands, and several recent years of lower than normal spring rainfall, conditions have been ideal for the spread and intensification of black stain root disease (*Leptographium wageneri*) by stressing the Douglas-fir trees and increasing insect vector abundance and activity (Angwin 2003). Increased levels of black stain

activity have been observed in several proposed shrub and pole treatments units, a few of which were pre-commercially thinned by hand in recent years without the appropriate restriction on the season of operation.

Under this alternative, the levels of moisture stress in Douglas-fir trees would continue to be high and this disease would continue to kill Douglas-fir trees on the edges of existing and newly established root disease centers. The shrub and pole seral units that have the black stain limited operating period indicated in Appendix B - Table B-2 are considered to be at high risk for some level of damage from this disease under the no action alternative, either because they show evidence of disease presence now or they are in relatively close proximity to existing disease centers. This group of units totals approximately 683 acres. Because the local variety of this disease only affects Douglas-fir trees, and because there are many hardwood trees and occasionally other conifer species present, the cumulative effects in terms of future canopy cover, relative stand density, opening sizes, etc. would be insignificant for the proposed treatment units combined and at the LMK watershed level.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Reduce Stand Densities

With only a single treatment of thinning (modeled to occur in 2009) and fuels cleanup (modeled to occur in 2011), without any follow-up maintenance treatments, resulting percent of maximum SDI is presented in Figure 8 through Figure 11. The results of the no action alternative are also shown in these figures to provide an easy comparison between the two alternatives.

Current direction for conifer density management in Region 5 of the Forest Service directs managers to not exceed 60 percent of max SDI when designing vegetation thinning treatments and to ensure that this level will not be reached again for at least 20 years after the thinning treatment (2470/5150/3400 Blackwell, 2004).

As displayed in Figure 8 and Figure 10, even after treatment, the noncommercial stands quickly exceed this 60 percent of max SDI goal. The shrub and pole grouping reaches this threshold at about 10 years after treatment and the early mature and older grouping exceed it is in less than five years after treatment. Because almost all of the noncommercial units are currently limited to hand only treatments, it is physically infeasible to cut and treat hardwoods greater than four inches DBH and conifers greater than six inches DBH in very dense stands. This physical limitation has been modeled for these groupings and is the primary reason why the noncommercial hand only treatments do not have a longer lasting effect in terms of density reduction.

Figure 8 and Figure 10 show that the commercial groupings, in which it is very feasible and planned to remove larger diameter fuels and trees, have much longer lasting effects in reducing stand densities. For the commercial shrub and pole grouping (Figure 9) 60 percent of max SDI

would not be reached for approximately 25 years after initial treatment, and for the commercial natural stands grouping it would not be reached for approximately 35 years after initial treatment.

An important factor when discussing the future density of trees, and potential flame lengths, is the significant sprouting potential of our local hardwood species. Typically, when a hardwood stem is cut or top killed by fire, one or more sprouts develop from the base of stems or along the remaining aerial portion of the stems. The numbers of sprouts and their initial height growth are dependent on the species of tree, diameter of the stem, and the health of the tree prior to cutting. In general, the larger and healthier the tree, the greater the number and height growth of resulting sprouts.

Recent observations of sprouting response in plantations and natural stands that have undergone fuels treatment or release and thinning treatment in the last 5 years suggest several strategies that can reduce the quantity and height growth of new sprouts: (1) Thinning individual stems from below, cutting the smallest stems and leaving the larger stems, can somewhat reduce sprouting potential, especially height growth, because the smaller trees generally have less developed crowns and consequently less stored resources for sprouting; (2) When thinning sprout clumps of trees, cut only the smallest ¼ to ½ of the stems based on diameter, leaving the largest stems per clump to grow and utilize the stored resources in the root crowns.

Implementation of this alternative would still result in many sprouts. By thinning individual stems from below and by cutting only the smallest trees in each clump of older stems, total numbers and heights of sprouts would be mitigated to some degree. Also, when thinning the older shrub and pole stage plantations, a greater residual canopy closure (about 60 percent) would be left in the areas containing almost pure hardwoods, and less canopy closure (40 to 50 percent) would be left in the areas containing a high proportion of conifers and significantly fewer hardwoods.

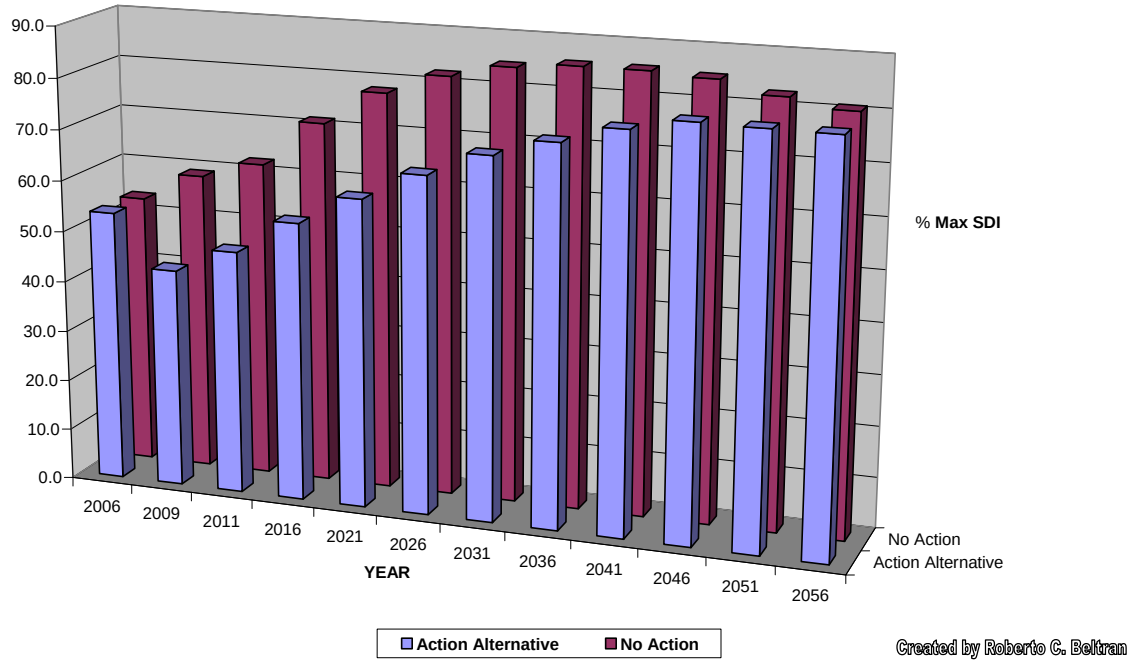

Figure 8. Comparison of percentages of maximum stand density index with and without treatment for the shrub and pole noncommercial groups

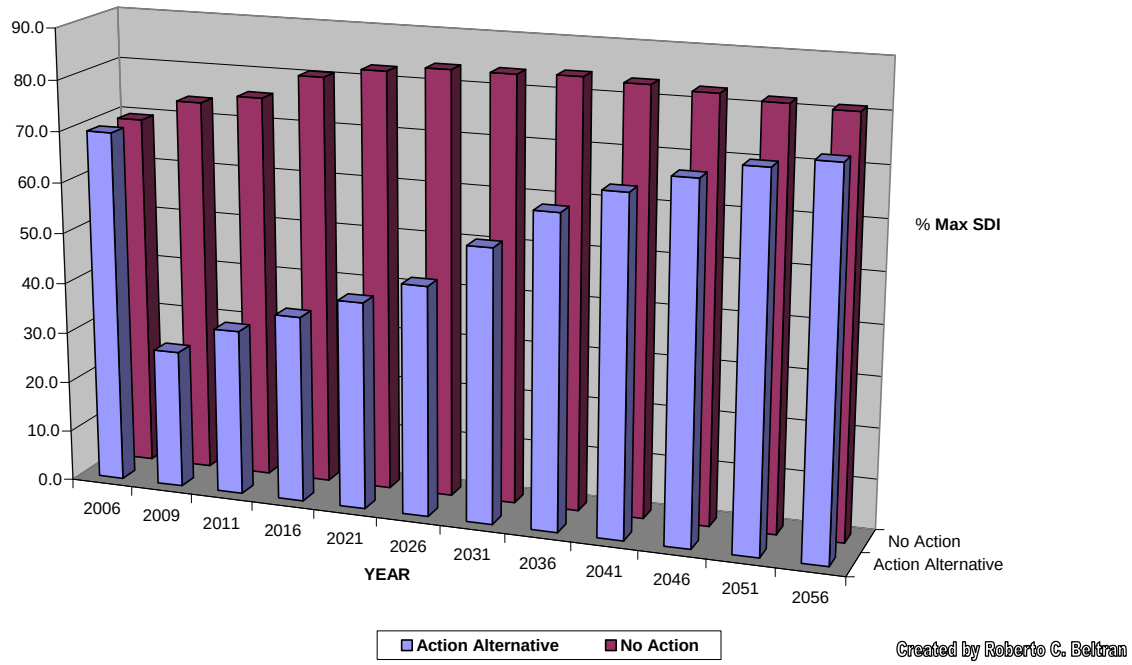

Figure 9. Comparison of percentages maximum stand density index with and without treatment for the commercial shrub and pole groups

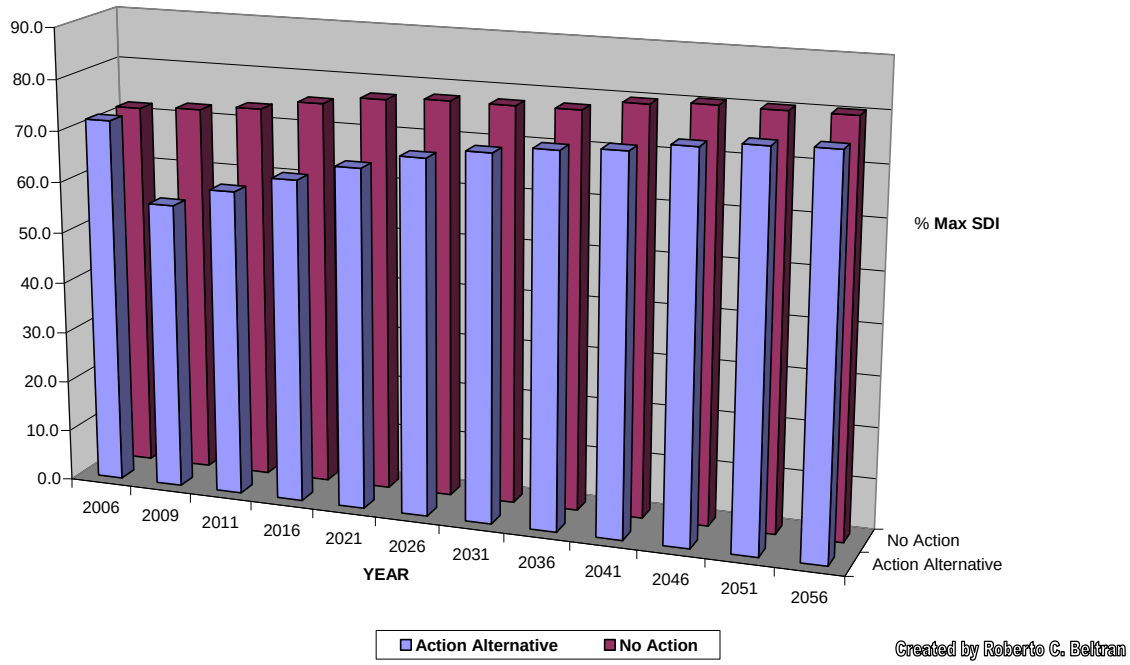

Figure 10. Comparison of percentages maximum stand density index with and without treatment for the early mature and older noncommercial groups

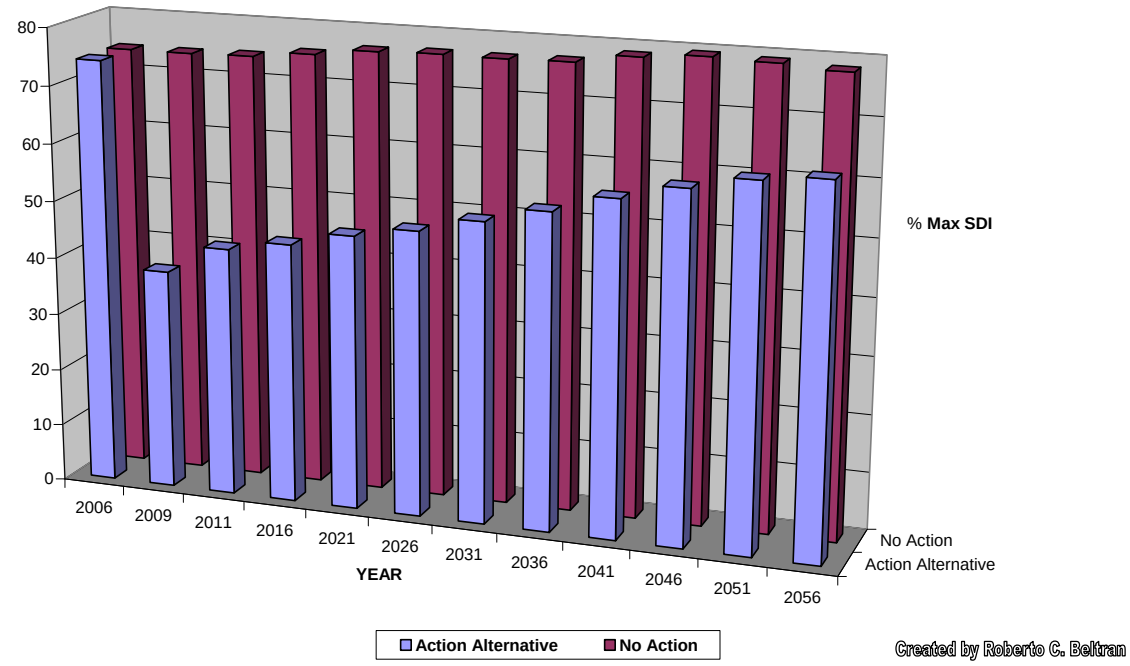

Figure 11. Comparison of percentages maximum stand density index with and without treatment for commercial early mature and older groups

Both shade-tolerant and -intolerant brush species are likely to regenerate from seed if the forest canopy is reduced significantly. Shade-intolerant species often have seed banks that readily germinate after fire, logging, or windthrow. Within the project area, deerbrush and the manzanitas store seed in the forest floor that can remain viable for many years (50 or more), and large numbers of seedlings can germinate following severe disturbances to the tree canopy and forest floor. This is one reason for the project design features that restrict the degree of canopy level thinning (Appendix C, Silviculture design features 1, 2, and 3).

An important objective of this project is to reinitiate the regular use of low-intensity fires for cultural and ecological purposes. Such regular use of fire was previously successful in maintaining relatively open forests, and in the long run, there is no reason to expect that it would not be successful again. However, because of the currently increased density of tanoak trees, multiple cuttings of sprouts and seedlings in addition to the use of fire may be necessary in many stands to establish conditions where fire alone can adequately maintain desired conditions.

Figure 12 through Figure 15 display the percent of basal area by grouping that would be lost. For easy comparison, the no action alternative is also displayed. Figure 12 shows a slight reduction of potential mortality from fire in the noncommercial shrub and pole group, but the effects are limited. Potential mortality five years after treatment would be 93 percent, compared to 97 percent for the no action alternative. At 45 years after treatment, potential mortality would be 96 percent, compared to 100 percent. Figure 13 shows a reduction in potential mortality from fire in the commercial shrub and pole group, but these benefits last only 35 years. Potential mortality five years after treatment would be 36 percent, compared to 89 percent for no action alternative. At 40 years after treatment (year 2051), potential mortality would be 86 percent, compared to 99 percent. Reductions in potential mortality from fire in both of the early mature and older stand groupings are displayed in Figure 14 and Figure 15. However, within the noncommercial stands these benefits become much less pronounced 40 years after treatment. By performing follow-up thinning and/or fuels treatments, potential losses from severe fire can be further reduced.

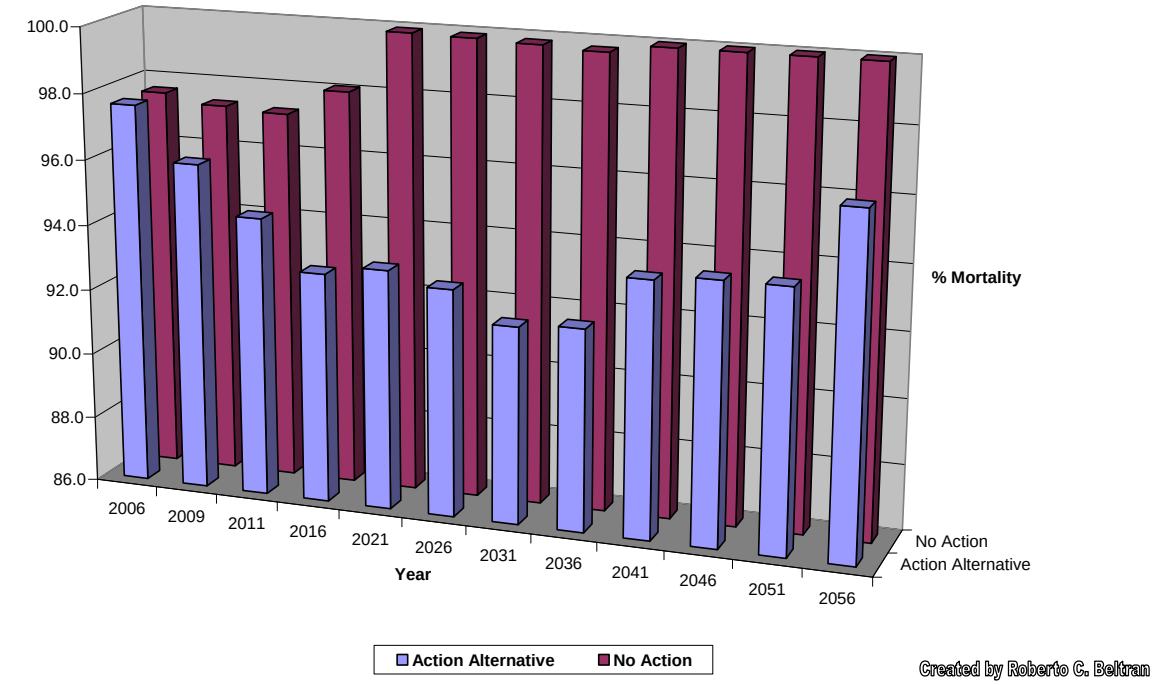

Figure 12. Percent basal area mortality with and without treatment for the noncommercial shrub and pole groups

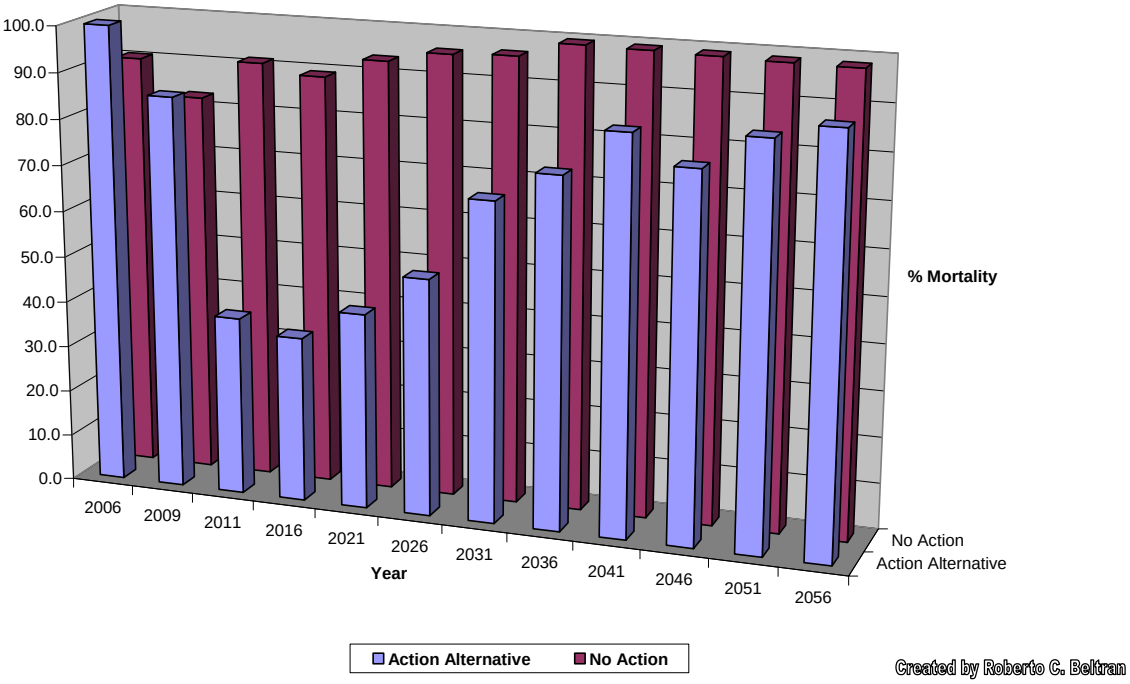

Figure 13. Percent basal area mortality with and without treatment for commercial shrub and pole groups

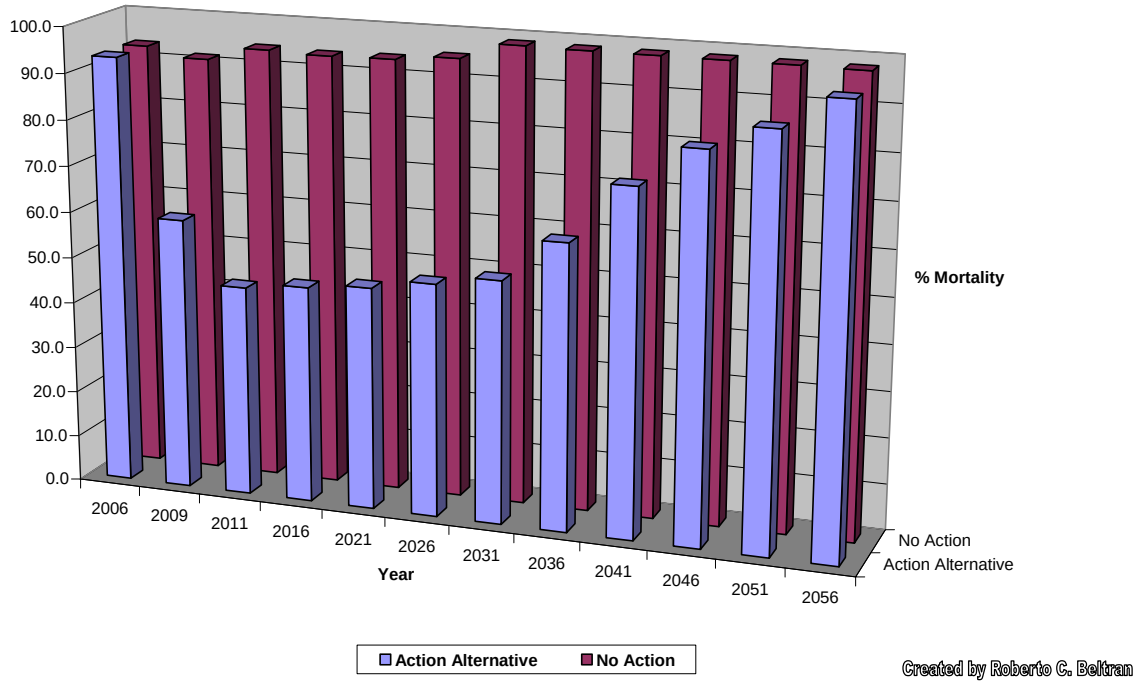

Figure 14. Percent basal area mortality with and without treatment for noncommercial early mature and older groups

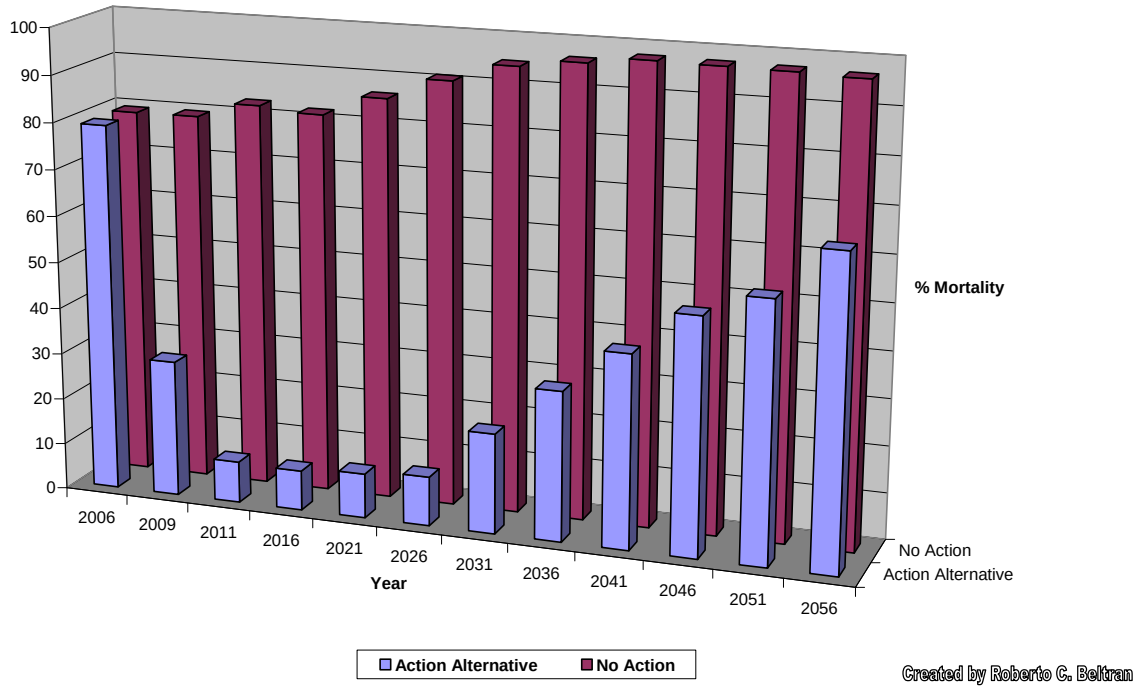

Figure 15. Percent basal area mortality with and without treatment for commercial early mature and older groups

Increase Average Tree Diameter and Maintain Healthy Hardwood Component

Existing and future average tree diameters (quadratic mean diameter (QMD) in inches) for the stands in each grouping would be as follows with just a single thinning treatment. The future QMD from the no action alternative is also displayed for easy comparison (Table 14).

Table 14. Existing and future average tree diameters (quadratic mean DBH in inches) under no action and proposed action alternatives

Stand Grouping	Existing (2006) QMD	Future (2056) QMD No Action	Future (2056) QMD with one treatment
Shrub and pole, noncommercial	7.0	14.6	16.0
Shrub and pole, commercial	7.9	16.2	18.7
Early mature and older, noncommercial	14.7	19.1	23.8
Early mature and older, commercial	15.5	20.2	29.4

It is easy to see that thinning treatments as modeled would result in greater future tree diameters than if no thinning treatments were implemented. The gains in diameter growth are in the commercial groupings where thinning treatments would reduce the density of canopy level trees, in addition to thinning understory trees.

By implementing thinning treatments that maintain or enhance the development of a healthy hardwood component, both structural and species diversity would be enhanced. Such diversity better enables the stands and ecosystems to respond to environmental stressors and disturbances with fewer negative effects.

The goals of the proposed action are not to convert pure conifer stands or aggregations to pure hardwood or hardwood/conifer mixes, but to attempt to maintain or enhance existing hardwoods where they are still present in reasonable numbers and in such a condition that they can respond to increased growing space, light, and soil moisture. This objective is most easily met in the youngest stands where hardwoods are still a major component of the canopy, they are relatively upright, and they have a high proportion of sun leaves. In this situation, there is also less damage to them expected to occur during thinning operations.

In older stands, where the hardwood layer has been overtopped by conifers for many years, species like black oak and madrone have less dense crowns. Many develop a heavy lean as the only living branches are those extending into pockets of light, and the leaves become adapted to “shade”. In this situation, there is much greater possibility of significant damage during thinning operations, especially when removing larger overtopping conifers. Tanoak trees can also be shocked, and suffer top and tip kill when shade leaves are suddenly exposed to full sunlight. This is another reason for the project design features that specify minimum canopy closure, and why the natural stands that have been previously thinned could be reduced to a lower canopy closure than those that have never been commercially thinned.

For FVS modeling, we assume that commercial thinning by ground or skyline logging systems in early mature and older stands would result in 25 percent loss of hardwood trees

between 6 and 20 inches DBH. In the helicopter harvest units we assume 40 percent damage to the hardwoods between 6 and 20 inches DBH and 10 percent damage to those over 20 inches DBH. Although these are some of the very trees we are trying to save and promote, if we do not remove a portion of the overtopping conifers soon, hardwood losses would be even greater in the future.

By implementing even a single thinning treatment, relative hardwood presence over time in proposed treatment units would be similar or greater than that of the no action alternative (Table 15). Future hardwood stocking as indicated by the average percent of total basal area would be as displayed below for each of the four stand groupings. The results of the no action alternative are provided for comparison.

Table 15. The percent of hardwood basal area relative to total stand basal area (BA) under the no action and proposed action alternatives

Stand Grouping	Existing (2006) % Hardwood BA	No Action Future (2056) % Hardwood BA	Proposed Action Single thinning Future (2056) % Hardwood BA
Shrub and Pole, noncommercial	30.8	10.2	12.0
Shrub and Pole, commercial	16.5	7.4	12.7
Early mature and older, noncommercial	12.2	9.7	9.1
Early mature and older, comm.	8.7	6.5	7.6

What the above table does not indicate is the very high proportion of hardwood basal area in each grouping that is composed of very small understory trees versus what is from canopy level trees, which have a more immediate potential to develop healthy crowns and produce mast. Because the noncommercial treatments in early mature and older stands would only cut the smallest diameter trees of any species, and no canopy level conifers would be removed, the effects to existing canopy level hardwoods would be nearly the same under both alternatives. It is only because the no action alternative leaves many small-diameter hardwood stems in the understory of this grouping that the future percent of hardwood basal area is slightly higher under no action alternative than that for the proposed action alternative. Within this particular grouping, the potential for enhancing the presence of mast-producing hardwoods is essentially non-existent and relative hardwood stocking would continue to fall.

By implementing additional thinning treatments that continue to favor future canopy level hardwoods, the relative proportion of future hardwood stocking in treatment units can be further enhanced above that of the no action alternative in all but the noncommercial early mature and older grouping.

Cumulative Effects

The boundary for cumulative effects for vegetation is the LMK watershed, the time is 30 years in the past and 50 years into the future. The list of projects used to analyze cumulative effects is given in Appendix D – Tables D-1 and D-2.

Reduce Stand Densities

By reducing the density of trees, levels of competition between trees for soil moisture, nutrients, and light would be reduced. Consequently, rates of mortality would also be reduced as was indicated in Figures 13 through 16.

Because the Douglas-fir black stain root disease (*Leptographium wageneri*) can be spread by root feeding bark beetles and weevils, in addition to root-to-root contact, it is important to minimize potential disturbance of the root systems and boles of residual Douglas-fir trees and to restrict all cutting operations in stands near known disease centers to only occur between July 1 and August 31, when this type of insect activity is minimal and cut stumps can dry prior to the next season of insect activity.

By implementing the above mentioned design features, the combined effects of increasing available soil moisture, nutrients, and light for the growth of residual trees; widely spacing residual Douglas-fir trees to minimize root contacts in units that now show signs of the disease; and by maintaining or enhancing the levels of other species present within treated stands; future mortality losses due to the black stain root disease would be reduced over time within treated units. However, this beneficial effect would be negligible within the larger LMK watershed.

A strategy to minimize potential stem breakage and stability problems is to complete early and periodic thinning which would maintain growing space for trees to expand crowns, roots, and stem diameters. However, for overstocked stands with height to diameter ratios near or over threshold, it is important to not perform aggressive thinning that leaves residual trees vulnerable to excessive damage. Thus, project design features (Appendix C, Silviculture design features 1, 2, and 3) would require a minimum level of residual canopy closure were specified. Also, by implementing primarily thinning from below, the least stable and weakest stems would be removed first, thereby reducing the stand level susceptibility to damage.

Increase Average Tree Diameter and Maintain Healthy Hardwood Component

Although continued hardwood enhancing treatments combined with regular low-intensity fire disturbances would have substantial direct and indirect benefits to stand level diversity and resiliency over time, given the limited amount of treatments associated with this proposed action when combined with past and reasonably foreseeable future actions within the LMK watershed, there would be extremely limited cumulative beneficial effects in terms of ecosystem health or resiliency at the watershed level. However, in terms of enhancing some culturally important values such as traditional gathering of certain products and restoring the traditional use of fire in particular places, the benefits may be very important.

Conclusion: Improve forest health by reducing stand densities to prevent additional fuels build-up

- *Reduce stand densities to be below 60% of maximum SDI at years 2011 and 2031.*

No Action Alternative: Regional recommended 60 % of maximum SDI is currently exceeded in all but a few shrub and pole stands. The average percent of maximum SDI for the groupings would be between 62 -76% in year 2011 and between 77 - 85% in year 2056. The majority of proposed units would continue to experience high rates of mortality and natural pruning well into the future or until a major disturbance reduced stand density. An uncontrolled fire would potentially kill 83 to 97% of the total basal area in proposed units groupings.

Proposed Action Alternative: Stand densities would be reduced to between 33 - 43 % of maximum SDI in commercial treatment groupings, and 48 - 60% of maximum SDI in the noncommercial groupings immediately following treatments. Most units in the noncommercial (hand) groupings would quickly exceed the recommended stocking density since only trees <6 in DBH could feasibly be removed. The average for commercial groupings would not reach 60% of max SDI for 25 to 35 years. Immediately after treatment, an uncontrolled fire would potentially kill <10 to 40% of the total basal area in commercial stand groupings and 46 to 95% in noncommercial stand groupings.

Conclusion: Promote the development and maintenance of diverse stand structures and species composition

- *Increase average tree diameters (quadratic mean DBH in inches at year 2056)*
- *Maintain a healthy hardwood component well into the future (ave % of total basal area in hardwoods in year 2056)*

No Action Alternative: Average tree diameters (quadratic mean DBH in inches) would increase slowly over time and in 2056 would approximate 14.6 and 16.2 inches in the shrub and pole groupings, and 19.1 and 20.2 in the natural stand groupings, if no major disturbances occurred over the next 50 years.

Without thinning of encroaching conifers, the proportion of hardwood basal area within units, and the larger LMK watershed,would continue to fall rapidly and would average approximately 7 – 10% at year 2056. Levels of moisture stress would continue to be high and the risk for significant damage from black stain root disease on Douglas-fir trees would persist on approximately 683 acres.

Proposed Action Alternative: Average tree diameters (quadratic mean DBH in inches) would increase at a higher rate and in 2056 would be approximately 16.0 and 18.7 inches in the shrub and pole groupings, and 23.8 and 29.4 in the natural stand groupings.

The proportion of hardwood basal area in treatment units would continue to decrease with only one thinning treatment, and would be approximately 8 – 12% at year 2056. This is only slightly better than the no action alternative, but with additional thinning and burning treatments, it could be significantly higher. Levels of moisture stress and stocking of Douglas-fir would be reduced, decreasing the magnitude of potential damage from the black stain root disease.

Concern: *To reduce damage to residual trees, project design features (Appendix C, Silviculture #s 1, 2, and 3) would require minimum levels of residual canopy closure.*

Other Disclosures for Vegetation Resources

Carbon Emissions and Sequestration

Forest management treatments implemented under the proposed action alternative would change forest ecosystem carbon pools. It is anticipated that an increase in carbon sequestration would occur over the next 20 to 50 years. Commercial thinning operations would convert live tree carbon to long-term storage and carbon emissions resulting from fuels treatment should be offset by increased growth in the live tree and understory vegetation layers. If biomass can be removed and utilized, carbon sequestration benefits would increase.

In the commercial harvest units, thinning operations would remove live trees producing products and slash. Carbon held in slash would be emitted with or without capture depending on whether slash is burned onsite or is removed and utilized. Follow-up fuels treatment would convert carbon in the standing dead, understory vegetation, downed woody, and forest floor carbon pools to emitted carbon with or without energy capture depending on utilization. Treatment effects would increase growing space in the live tree layer with an expected increase in carbon sequestration. Likewise, vegetation growth in the understory and forest floor layers would increase sequestration in these pools as well.

In precommercial thinning units, treatments would reduce carbon in the live tree, dead tree, and understory carbon pools but none of the carbon would be converted to long-term storage as forest products. Instead, this material would be released as emissions with or without energy capture. In the precommercial units, carbon emissions would likely balance out the increased sequestration that occurs as a result of increased growing space. There is an opportunity to increase the amount of biomass removed for utilization should low impact ground equipment be allowed. If smaller material in these units could be removed for utilization, carbon sequestration benefits would increase.

Conclusion: Carbon Sequestration

- It is anticipated that under the proposed action alternative an increase in carbon sequestration would occur over the next 20 to 50 years.

Environmental Consequences to Soil Resources

Affected Environment

The Orleans Community Fuels Reduction and Healthy Forest project areas lies near the periphery of two rock belts in the Klamath Mountains Geologic Province. Metasedimentary rocks of the Galice formation, in the Western Jurassic Belt have been thrust over the metavolcanic and volcaniclastic rocks of the Hayfork Terrane, of the Triassic-Paleozoic Belt. The contact is evident as the Orleans Thrust Fault. The field expression of the fault, and its associated splays is given by bands of ultrabasic rocks, primarily serpentenite, the northern part of the project area is underlain by a minor occurrence of the Rattlesnake Creek Terrane, also a member of the Triassic-Paleozoic Belt. The July 2001 Amendment by the California Air Resources Board (ARB) to the Asbestos Airborne Toxic Control Measure (ATCM) prohibits the use of restricted materials for unpaved surfacing unless it has been tested and found to have an asbestos content that is less than 0.25 percent. The test method required is ARB Test Method 435 or a method approved by the Executive Officer of the ARB. Further information can be found at *http://www.arb.ca.gov/toxics/asbestos.htm*, or from the county ARB.

Soils within the project area are as variegated as the lithologies they overlie. In the south portion of the project, gravelly loams of the Clallam family, derived from meta-sedimentary

rocks, make up about 50 percent of the area. About 30 percent are clay loam soils of the Holland deep family. These are soils have a meta-igneous derivation. Hugo family soils, gravelly loams derived from metasediments, make up about 10 percent of the southern area. The remainder is gravelly/silty loams derived from ultrabasic material, associated with the aforementioned fault zones.

The North and Central portions of the project area are underlain by gravelly loams of the Clallam family, gravelly, clay loams of the Ishi Pishi family, gravelly loams and mixed alluvium of the Horseshoe family. A rather large area of the south portion of the project area is underlain by clay loams of the Aikens-Holland family, derived from meta-igneous parent material. There are also gravelly clay loams derived from ultrabasic parent material, associated with fault zones.

The geomorphic expression of the area is given by old (post-Pleistocene) dormant landslide terrains, overlying the bedrock. These are evident as areas of deep, weathered soils that occur in the central and north portions of the project area. In the south portion of the project area, the upper elevations have undergone shear and weakening from the Orleans Thrust Fault, with the Klamath River removing buttress material by glacial outwash and high water events. There are several recently active unstable areas, particularly adjacent to proposed Unit 16 in the south and Unit 190 in the central portions of the project area. These areas and other unstable areas have been avoided by buffering during the layout process. The primary mass-wasting phenomena found throughout the project area were inner gorge slides associated with peak flows. These have been avoided by riparian reserve buffering. No unstable areas were encountered during road reconnaissance and layout.

Alternative 1 - No Action – Short and Long-term Soil Productivity

Direct, Indirect and Cumulative Effects

Maintaining dense forest vegetation conditions in the project area increases the risk of more wildfire acres burning with moderate and high burn severities. Based on burn severity data from 1977 to 2002 on the Klamath National Forest, a future wildfire could burn approximately 14 percent of the project area with a high burn severity, 33 percent moderate severity and 53 percent at a low severity. Under the no action alternative, the percent of land burned at a high severity could increase to 20 to 25 percent, depending on the amount of down fuels and weather conditions. Moderate severity could increase to 40 percent of the fire area. Wildfire surface erosion rates would vary from 0.45 to 5.7 tons/acre depending on slope, soil detachability and burn severity. Removal of the litter and duff layers in future fires could reduce soil mesofauna populations (organisms between 0.2 mm and 1.0 cm in size) and favor a fungal and bacterial system that reduces decomposition rates and nutrient cycling. Future wildfires would change the forest floor and increase the time frames for rebuilding the litter layer and mesofauna population recovery. Future wildfires could also cause organic matter decomposition rates to increase due to more sunlight and changes in organic litter composition.

Under this alternative, there would be no new soil disturbance or direct or indirect effects in the absence of wildfire. Therefore, there would be no cumulative effects under the no action

alternative. The level of existing detrimental soil disturbance within the project area would remain unchanged. Nutrient cycling would be maintained as fine organic matter increases as duff/litter layers. Soil fertility would be maintained in managed stands due to the increased organic matter on the soil surface and in the soil. Compacted soils (reduced porosity) in portions of old skid trails would slowly increase their porosity due to biological activities and thereby regain lost soil productivity over the next 40 to 50 years.

Alternative 2 – Proposed Action – Short and Long-term Soil Productivity

Direct Effects

Tractor logging and tractor bunching can result in soil compaction and/or soil displacement that exceeds soil quality standards (SQS) on highly used main skid trails or around large slash piles. Soil disturbance and compaction, however, can be minimized when logging operations occur when the soils are dry. For the proposed action alternative, it is estimated that 30 acres associated with main skid trails and slash piles may exceed the SQS guidelines (Soils and Geology Report, Snavely 2008). This acreage amount is below the 65 acre (15 percent) detrimental compaction guideline. Skyline, helicopter logging and underburning would have minimal negative effects on soil productivity. Thus, this alternative would meet the LRMP and SQS guidelines for soil cover, porosity, soil organic matter content, surface organic matter levels, soil moisture regime, soil hydrologic function, buffering capacity and would maintain a well functioning soil biological system.

Detrimental compaction
Detrimental compaction is compaction that results in a greater than10% decrease in soil porosity as measured at the 4 to 8 inch soil depth

Indirect Effects

Indirect effects on the soil ecosystem are secondary reactions to direct effects. The most common secondary reactions are increased surface erosion (from ground disturbance, soil cover removal), reduction in fertility (compaction, removal of fine organic materials), and reduced vegetative growth (detrimental compaction, loss of fine organic materials).

Ground-based yarding would cause a loss of nutrients in the skid trails due to soil displacement and skid trail erosion. Reduced soil porosity would reduce growth of any trees and other vegetation that would grow on these skid trails, post-harvest. Installing water bars on all skid trails would be effective in controlling runoff and preventing off-site sedimentation. Recent monitoring of best management practices implemented for skid trail rehabilitation noted that water bars are very effective in controlling erosion and preventing sediment from reaching a stream course. Monitored water bars were 96 to 100 percent effective (Klamath National Forest 2000; 2001).

In addition to ground-based yarding, skyline yarding would result in 3 to 8 percent detrimental disturbance. There would be a loss of nutrients and soil organic matter in the disturbed portion of the corridor. The amount of

Detrimental disturbance
Detrimental disturbance is where soil displacement of the topsoil removes greater than 15% of the soil organic matter in the upper 12 inches of soil

reduced soil productivity would be measurable within the disturbed portion of the corridor, but would not be measurable on an acre basis due to the narrow size of the disturbance. Similar to skid trails, installing water bars on all cable corridors would be effective in controlling runoff and preventing off-site sedimentation. Thus, the amount of area with reduced soil productivity overall would be within the Region's and Forest's guidelines of less than 15 percent of detrimental disturbance in the activity area.

Helicopter yarding would cause a slight insignificant loss of nutrients where the trees fall or if trees slide down slope.

Ground-based log landings and those for helicopter use would result in site productivity which would be lower due to compaction and loss of nutrients. There would be a change in the types of vegetation grown on these sites, more towards grass and brush with stunted trees slowly reoccupying these sites. Rehabilitation of non-road prism landings as described in the design features would minimize short- and long-term erosion (Appendix C). The amount of area in these landings however, is very small and the resulting amount of disturbance would be within the Region's and Forest's guidelines.

It is estimated that fuels treatments involving hand piling and subsequent burning of piles would occupy one to 25 percent of a piled area depending on the amount of material to be piled (Laurent 2006b). The nutrient loss from the burned pile area would have a minor effect on soil productivity (loss of nitrogen). Other nutrients, such as cations, would increase in the soil due to leaching. Thus, this activity has a high probability of meeting all evaluation criteria.

The effects of each alternative on the soil resource have also been assessed using the following Region 5 SQS (USFS, 1995a) and the Six Rivers NF's LRMP Standards and Guidelines USFS, 1995b). The assessment of each Standard and Guideline is accomplished by the measurable parameters listed beneath each Standard and Guideline. The soil mitigation measures or project design criteria were developed to ensure that the project would meet these evaluation criteria.

1. **Maintain soil productivity by retaining organic matter on the soil surface and by retaining organic matter in the soil profile** [LRMP Ch. 4, Sec. 3-3; SQS 1a, 1c, 1c(1)].
   - Meet the recommended soil cover amounts (60 to 70 percent) in order to prevent accelerated erosion from exceeding the long-term soil formation rate.
   - Retain at least 50 percent cover as fine organic matter (<3 inch dia. material) in all units.
   - Dedicate no more that 15 percent of a harvest unit to primary tractor skid trails, cable yarding corridors and landings.
   - Reuse existing skid trails and landings whenever practical.
   - Maintain at least 85 percent of the existing total organic matter in the upper 12 inches of soil.

2. **Minimize changes in the site's ability to cycle nutrients and maintain site productivity** [LRMP Ch. 4, Sec. 6-14; SQS 1a, 1b, 1c(1)].
   - Maintain at least 85 percent of the existing total organic matter in the upper 12 inches of soil.
   - Maintain 30 to 50 percent of existing duff mat (spatially).
   - Maintain at least 50 percent fine organic matter (<3 inches in diameter) on site.

- Retain at least 60 to 70 percent percent soil cover in order to prevent accelerated erosion from exceeding the long-term soil formation rate.

3. **Retain CWD and protect existing CWD** [SQS (2b); **[**LRMP Ch. 4, Sec. 3-6].
   - Protect existing CWD as much as possible by having machinery avoid larger diameter logs and using lower intensity fuel reduction methods.
4. **Minimize soil and litter disturbances resulting from ground based yarding and heavy equipment** [LRMP Ch. 4, Sec. 3-5 and 6-16]**.**
   - Reuse existing skid trails and landings whenever practical.
   - No new constructed skid trails will be made.
   - Skidding equipment will be generally restricted to slopes <35 percent.
5. **Prescribed fire should be planned to minimize the consumption of litter and CWD** [SQS 1a, 1c(2a), 1c(2b)].
   - Prescribed underburns, tractor bunching and hand piling will be used to maintain the recommend soil cover amounts and to protect appropriate levels of CWD.
   - Prescribed underburns, tractor bunching and hand piling will be used to retain at least 50 percent cover as fine organic materials (<3 inches diameter).
6. **Maintain the functionality of the soil ecosystem by maintaining a sites ability to cycle nutrients and maintaining the biological components (fungi, arthropods, bryophytes)** [LRMP 6-1, 6-2, 6-14(3c), 21-12 and 21-20].
   - Dedicate no more that 15 percent of a harvest unit to primary skid trails and landings.
   - Maintain at least 50 percent fine organic matter on the soil surface and sufficient duff mat (30 to 50 percent)
   - Protect the existing CWD especially the decomposition class 4 and 5 logs.

For items 1, 2, and 3 above, recovery would be considered to be complete within one or two years after project actions are completed. Item 4, regarding detrimental compaction, is in a continuum of recovery for a period of up to 30 years. Items 5 and 6, as per Erosion Hazard Ratings performed on the Wilder Fire burn area, recovery was complete after three years.

Each management activity is rated for its ability to meet the applicable evaluation criteria by using descriptive terms (low, moderate, moderately high and high) (Table 16 and Table 17). A probability rating of moderate, moderately high or high is just an indicator on the likelihood of the evaluation criteria being met. This does not mean that the standard and guideline would not be met. The ratings are more like achievement expectations. As an example, not meeting the soil cover guideline does not imply that the standard and guideline was not met. It means that soil erosion would be a little higher then what management would like and that some soil material as well as nutrients would be lost. It would require a substantial departure from the cover guideline over an extended period of time to cause a significant reduction in soil productivity. A rating of low would imply that there is a strong likelihood that the standard and guideline would not be met.

Table 16. Probability of no action alternative meeting the six identified standards and guidelines

Alternative	Management Activity	Evaluation Standards and Guidelines					
		1	2	3	4	5	6
No Action	None	High	High	High	High	NA	High

Table 17. Probability of proposed action alternative meeting the soil resource evaluation standards and guidelines

Alt.	Management Activity	Evaluation Standards and Guidelines					
		1	2	3	4	5	6
B	Ground-based Yarding	High-Mod	High	High	Mod-High	NA	High
B	Skyline yarding	High	High	High	Mod-High	NA	High
B	Helicopter yarding	High	High	High	High	NA	High
B	Landings	High	High	High	Mod-High	NA	High
B	Hand piling	High	High	High	NA	High	High
B	Underburning	High	High	High	NA	High	High

In general, the following effects would be expected:

Ground-based yarding could cause a loss of nutrients in the skid trails due to soil displacement and skid trail erosion. Reduced soil porosity would reduce growth of any trees and other vegetation that would grow on these skid trails, post-harvest. Installing water bars on all skid trails is very effective in controlling runoff and preventing off-site sedimentation. Recent BMP monitoring of skid trails revealed that water bars were very effective in controlling erosion and preventing sediment from reaching a stream course. Monitored water bars were 96 to 100 percent effective (Klamath National Forest 2000; 2001). Mitigation measures pertaining to skid trails are designed to minimize erosion.

Landings usually are drastically disturbed sites that have significant lower site productivity due to compaction and loss of nutrients. There will be a change in the types of vegetation grown on these sites, more towards grass and brush with stunted trees slowly reoccupying these sites. Rehabilitation of non-road prism landings as described in the mitigation measures will minimize short and long-term erosion. The amount of area in landings is very small and meets the Region's and Forest's guidelines.

Hand piling and subsequent burning of the piles would occupy one to 25 percent of the piled area depending on the amount of material to be piled (Laurent 2006b). The nutrient loss from the burned pile area will not have a significant effect on soil productivity (loss of nitrogen). Other nutrients, such as cations, will increase in the soil due to leaching. This activity has a high probability of meeting all the evaluation criteria.

Underburning would not disturb additional soil within harvest units or in units outside of the harvested units. Heat penetration into the surface soil during burning will be minimal to none. Generally, soil pH, P, and exchangeable K, Ca, and Mg increase in the soil immediately after fire (Wells et al. 1979). Also, some of the seedbed in isolated spots may be disturbed and cause less vegetative growth over the short term. Erosion will be minimal to none because this low intensity burn will retain sufficient cover to protect the soil (Laurent 2006b). Required soil cover is 60-70% depending on slope steepness. This would result in a first-year surface erosion rate of 1.3 to 0.8 tons/acre. These rates would lower to 0.2 tons/acre in a few years. Soil productivity would be maintained.

Cumulative Effects

The cumulative effects boundary for soils, watershed, and fisheries resources is given in Appendix A – Map 8, the time-frame is the past 30 years and future 10 years. A list of projects considered is given in Appendix D. Currently existing detrimental soil disturbance ranges from 0 to 11 percent, with an average of 4 percent for the project area. Proposed logging activities combined with existing detrimental disturbances would not exceed the SQS threshold for detrimental disturbance (30 acres would exceed standards; 65 acres constitutes 15 percent of the project acres). Activities that result in disturbance include tractor logging and tractor bunching in areas that have been subjected to past wildfires and logging. The reuse of existing skid trails would minimize areas of new compaction and minimize the cumulative effects of multi-harvest entries over time. Greater details can be obtained in the Soils and Geology Report.

Conclusion: **Short and Long Term Soil Productivity**

- **No Action and Proposed Action alternatives**: There is a high probability that disturbance from the past, present and foreseeable future projects would not exceed soil resource evaluation criteria under either alternative. Short and long-term soil productivity would be maintained. All unstable landslide areas are outside unit boundaries and buffered.

Environmental Consequences to Riparian Reserves

Goal: Accelerate development of resilient riparian reserves with late-seral characteristics

Affected Environment

The OCFR project is located in the riparian headwaters surrounding the town of Orleans. The bulk of the riparian reserves are in headwater ephemeral or intermittent streams, or near springs. There are very few perennial streams within the project area. Perennial streams are found in the headwaters of Donahue Flat, Mud, Rosaleno, and Wilson Creeks in the north and Big Rock, Chimmekanee and Cheenitch Gulch in the south. There are approximately 406 acres of riparian reserves within the OCFR project area.

The OCFR Project is located in an area that has had an extensive history of past timber harvest activities which has altered the mosaic of vegetation patterns and elevated younger seral stages. Younger seral stages typically have greater stem densities and are at a greater risk of being lost due to wildfire.

The LMK Watershed Analysis (2003) assessed the condition of riparian areas throughout the Orleans Ranger District along the Klamath River corridor. In the larger landscape surrounding the project area (referred to Ikes in the LMK WA, pg. 3-79), approximately 10 percent of the riparian reserves have been substantially altered through past timber harvest. Approximately 60 percent of the riparian reserves are in early or mid-mature stands and 32 percent of the riparian reserves have a high or very high risk of fire.

Within the OCFR project area, the percentages of altered riparian reserves are much higher. Roughly 40 percent of the riparian reserves within this area have been previously harvested and are in plantations of varying ages with very high vegetation densities (Table 18). Riparian reserves within plantations that have small headwater channels (typically intermittent and ephemeral channels) have been significantly altered relative to vegetation composition and age.

Table 18. Riparian reserve acres by seral stage and high fire risk within OCFR

Seral Stage				Total (%)
Plantation	Early Mature	Mid Mature	Late Mature/Old Growth	
166 (41%)	47 (12%)	102 (25%)	91 (22%)	406 (100%)

It is important to note that many plantations within the project predate the Northwest Forest Plan and the Six Rivers LRMP. Therefore, many of the riparian reserves in plantations were completely harvested (no streamside buffers) or encroached within 25 to 40 feet of the active stream channel. The effect of this past management was that few to no large trees remain in some plantations or only a thin buffer of a selected few large trees. The effects of these management actions have reduced large woody debris recruitment potential and elevated fuel loads within these riparian reserves.

Past timber harvest activities within riparian reserves has resulted in a legacy of high fuel loads particularly within plantations. The stem densities within these riparian reserves are such that it is difficult in most areas to walk or penetrate and there is limited light reaching the forest floor. The result is a monotypic stand of young Douglas-fir with little riparian diversity even within the immediate vicinity of the stream channel. As a result of the past timber harvesting of riparian reserves, a few of the headwater stream channels have incised and gullied. The most notable channel that has gullied as a result of past timber harvest activities are portions of Mud Creek in Unit 134 (see OCFR Riparian Reserve Analysis Report - Appendix A for site-specific riparian reserve information).

While 40 percent of the riparian reserves are in plantations, the remaining 60 percent of the riparian reserves within the OCFR project area retain the bulk of their original riparian and channel characteristics and have been lightly managed or not managed at all (Table 18). Approximately 12 percent of the riparian reserves within the project area are in early mature seral stage and 48 percent are in mid mature and older seral stages, which tend to be more resilient to wildfire.

According to the LMK Watershed Assessment definition of high fire risk, 80 percent of the riparian reserves within the OCFR project area have a high or very high fire risk. Historically, wildfires have occurred throughout the project area. It is difficult to determine the current potential for wildfire within riparian areas due to the unpredictability of fire behavior. However, due to the extent of high to very high fire risk within adjacent upland stands, and given the fact that many of these stands have been converted to plantations, there is a high risk that a stand-replacing fire affecting riparian reserves within this area could pose a significant concern for

beneficial uses and riparian-dependent species. A wildfire through previously managed riparian reserves such as plantations would significantly impact future large woody debris recruitment and potentially increase sedimentation rates, impacting downstream domestic water sources. Most of the riparian areas at risk for wildfire are lower-order ephemeral, intermittent and some perennial streams located in the upper one-third of the hillslope. Wildfire has been actively suppressed within the OCFR project area and the riparian reserves would benefit from fuels reduction treatments that would result in more fire-resilient riparian reserves. Wildfire that occurs through a given area will always have a mosaic of burn intensities and severity. The intent of the OCFR project is to reduce fuel loads across the landscape and adjacent riparian areas so that when wildfire occurs, the landscape will be more resilient to wildfire and have fewer adverse impacts. It is important to set the stage so that wildfire can again become the maintenance tool necessary for ecosystem health.

Fire histories in selected riparian reserves were assessed in the Klamath Mountains (Skinner 2002). The study concluded that fire return intervals in riparian reserves were approximately double the fire return intervals from nearby upland forest sites. Fire return intervals in riparian reserves are more variable than in adjacent uplands and tend to be longer. Riparian areas may have enhanced the spatial and temporal diversity of landscapes by acting as occasional barriers to many low and moderate-severity fires.

Dwire and Kauffman (2003) examined fire and riparian ecosystems in the west and noted that fire frequency in certain forested riparian areas has generally been lower and fire severity has been more moderate than in adjacent uplands, but in other areas, fires have appeared to burn riparian areas with comparable frequency. The authors go on to state that impacts of land use and management may strongly influence fire properties and regimes in riparian areas and that cumulative impacts of human alterations are likely to exert the most pronounced influence on fire behavior during periods of drought and under conditions of extreme weather. Reardon et al. (2005) also assessed wildfire and riparian ecosystems and determined that fire in riparian areas can be intense and cause extensive damage to the vegetation. However, even after severe fires, recovery can be rapid within a couple of years to pre-fire conditions in some environments, but not all. The recovery of vegetation following fire reflects the combined disturbances of both the fire and post-fire storms. Reardon et al. (2005) concluded that carefully prescribed fire should not affect the accumulations of coarse woody debris either in the watershed or in the channel and that low-intensity prescribed fires do not kill stream shading shrubs and trees, and that fire can be used throughout the riparian areas without creating substantial damage.

Conversely, Rhodes (2007) concluded that mechanical fuel reduction treatments adjacent to or within portions of riparian reserves will result in loss of large wood, channel complexity, and negatively impact water quality. Rhode’s main premise is that if the goal is to benefit aquatic ecosystems, mechanized fuel reduction treatments are a lower priority when considering the suite of high priority road risks and water diversion and withdrawals throughout the West. Rhodes (2007) states that there is a high degree of certainty mechanized fuel reduction projects will

involve riparian reserves and that these treatments will increase erosion and sediment delivery to stream systems with consequent negative impacts on water quality.

Fuel reduction treatments within riparian reserves (including activities such as endlining) do not automatically result in detrimental impacts to the processes and functions of riparian reserves and negatively impact water quality. As part of the Northwest Forest Plan (e.g., FEMAT), the best available science was gathered to develop standards and guidelines that would protect riparian areas, water quality and aquatic habitat as well as establish ACS objectives. The combination of rigorous riparian reserve standard and guidelines and the ACS objectives resulted in the most stringent forest management practices in the Pacific Northwest and were determined to be more than sufficient to protect water quality and riparian values.

An added benefit of the fuel reduction treatments in riparian reserves beyond the reduction of fire risk is the accelerated recovery or regrowth of large-diameter trees in plantations for the purposes of future large woody debris recruitment. A key riparian component that has been altered due to past management activities within the project area is the reduction in large woody debris (LWD) recruitment potential. The principal mechanism for woody debris recruitment in stream channels is trees falling into riparian areas through natural mortality, landslide movement, wildfire, or windthrow. In headwater tributary channels, which are characteristic of most stream channels within the project area, woody debris recruitment is an important function providing in-channel structure, sediment routing, and wildlife and fisheries habitat. Past management activities have reduced the potential for large woody debris recruitment in many of the headwater streams within the project areas, mostly associated with plantations.

The primary measurable indicators used to assess the effects of fuel treatments in riparian reserves are: (1) acres of ground disturbance associated with treatments types, (2) acres of fire resilient riparian reserves, and (3) acres of improved large woody debris recruitment potential.

Generally speaking, hand treatments (e.g., hand piling and burning) to reduce fuel risks within riparian reserves have the least risk of sedimentation of adjacent stream courses, followed by helicopter, skyline and endlining treatments. Of these treatments, endlining trees in the outer edges of the riparian reserves have the potential for the greatest ground disturbance relative to the other fuels reduction treatment types. Nevertheless, given the limited selective thinning within riparian reserves and 80-foot distance from the actual stream course, the risk of sedimentation associated with endlining is still low.

The intent of the OCFR project is to reduce the excess fuel loads surrounding the community of Orleans. As such, it is important that the riparian areas within this footprint also be resilient to wildfire so that critical aquatic processes and functions are maintained and that downstream domestic water sources are not impacted in the event of a wildfire. Of all the diverse vegetation stands within the project area, plantations are at the greatest risk of being severely impacted during wildfire given their high stem densities and associated fuel loads. Given the fact that 40 percent of the riparian reserves within the project area are in plantations, it is important to blend riparian reserve treatments with those fuel reduction treatments in adjacent stands so that the entire landscape surrounding the Orleans community is more resilient to wildfire and that riparian

reserves can have the necessary structures and functions to retard the spread of wildfire. Acres of riparian reserve that are fire resilient (based on seral stage and stem densities) are a measurable indicator that illustrates the effects of the proposed treatments in reducing risk of wildfire.

Lastly, large woody debris is an important element in stream channel structure and sediment routing as well as for wildlife and fisheries habitat. It is critical that riparian reserves, particularly in plantations, include treatments that will accelerate the re-growth of large trees for the purposes of LWD recruitment and processes such as shading and bank stability. It is equally important to maintain large trees in the remaining riparian areas in natural stands, particularly in mid mature and older seral stages. Acres of riparian reserve having improved large woody debris recruitment potential is a measurable indicator that illustrates the effects of the proposed treatments in promoting the health and recovery of the riparian reserves within the project area.

Evaluation of Alternatives

A comparison of the measurable indicators for assessing potential impacts to riparian reserves by alternatives is shown in Table 19.

Table 19. Riparian reserve treatment types, fire resiliency, and LWD recruitment by alternative

Alternative	Treatment Type (acres)				Fire Resiliency* (acres)			Large Woody Debris Recruitment Potential** (improved acres)
	Hand	End-line	Skyline	Helicopter	H	M	L	
No Action	0	0	0	0	90	104	214	0
Proposed Action	376	19	8	4	194	66	148	166

*riparian reserve fire resiliency assumptions for no action:
high resiliency = late mature/old growth riparian reserves
moderate resiliency = mid mature riparian reserve
low resiliency = early mature and pole/shrub (plantations) riparian reserves

** riparian reserve LWD recruitment assumptions for No Action: plantations acres

*riparian reserve fire resiliency assumptions for proposed action:
high resiliency = treated mid mature and late mature/old growth riparian reserves
moderate resiliency = treated early mature riparian reserve and commercial age treated plantations
low resiliency = treated pole/shrub (noncommercial age plantations)
** riparian reserve LWD recruitment assumptions for Proposed Action: acres treated plantations

Alternative 1 - No Action

Direct and Indirect Effects

Treated Acres within Riparian Reserves and Large Woody Debris Recruitment

Under this alternative, there would be no management within riparian reserves and therefore no potential for direct effects of sedimentation of stream channels associated with ground-disturbing activities (Table 19 – 0 acres of ground disturbance). An indirect effect of not managing in riparian reserves, particularly in plantations, is that there would be no improvements (selective thinning) to encourage the growth of larger healthier trees for the purposes of LWD recruitment potential as well as shade and cover. Due to high stem densities, a wildfire in plantations that

affects riparian reserves has a high probably of being a stand-replacing fire. Such a wildfire has the potential to significantly reduce vegetation that provides shade, and delay the recovery of LWD recruitment potential, not to mention the increased potential for sediment delivery.

Increased Acres of Fire Resiliency

Under this alternative fuel loads would remain the same within the riparian reserves, particularly in younger seral stages such as in plantations which typically have a low resiliency to withstand wildfire and a higher probably of detrimental direct impacts such as erosion and sedimentation of stream channels (Table 19). Riparian reserves in early mature stands also have a low fire resiliency when compared to more mature stands but are more resilient than plantations. Fire resiliency in riparian reserves in late mature and old growth stands would likely not change based on the assumption that these areas already have a high fire resiliency due to their cooler temperatures. Fire resiliency in late mature and old growth riparian reserves within the OCFR project area are associated with true riparian vegetation and higher water tables such as the old growth units in Donahue Flat and Sunset Springs and would likely have the lowest probability of being negatively impacted by wildfire when compared to the surrounding landscape.

Wildfire history within the vicinity of the project area indicates that roughly 10 to 15 percent of recent past fires burn at a high intensity and the remaining areas are moderate to low (based on professional review of past Burned Area Emergency Report (BAER) records; e.g. Somes, Panther, Friday, Sims Fires). Given this history, and the unpredictability of weather conditions, it is difficult to predict how many riparian reserve acres would likely burn in the event of a future wildfire. Nevertheless, there is a reasonable likelihood that some unknown percentage of riparian reserves in plantations as well as in older seral stages (e.g., early and mid mature stands) within the project area would be adversely impacted in the event of a future wildfire.

Cumulative Effects

Cumulative effects under the no action alternative are the baseline for effects under the proposed action alternative and are discussed in the following section.

Alternative 2 - Proposed Action

Direct and Indirect Effects

Under this alternative, the fuel reduction treatments in riparian reserves would result in beneficial effects. The limited extent of proposed ground disturbance within riparian reserves and the potential sedimentation associated with ground disturbance is anticipated to be negligible (see Water Quality Section). It is extremely unlikely given the small acres of potential ground disturbance within riparian reserves (18 acres of endlining) that the small quantity of sediment that might be delivered to these headwater streams would ever be detectable or have any measurable effect compared to the natural background levels of sediment delivery. The effects of the proposed riparian reserve treatments would barely be detectable at the site scale and certainly not detectable downstream where beneficial uses exist. Beneficial effects to riparian reserves of the proposed treatments would be: (1) a increase in acres of riparian reserve having greater fire

resiliency (particularly in plantations and early mature stands), and (2) an acceleration of recovery of vegetation characteristics needed to attain ACS objectives (e.g. accelerated growth of larger diameter and taller trees that would provide better shade, cover and future large woody debris, more diverse riparian vegetation).

Treated Acres within Riparian Reserves and Large Woody Debris Recruitment

Under this alternative, a variety of fuel reduction treatments would occur in riparian reserves (Table 20). Of the 406 riparian reserve acres, a total of 376 acres or 93 percent are "hand" treatment units. Hand treatment operations are typically conducted by using chainsaws, weed-eaters with cutter heads, loppers, pole pruners, to name a few. This type of treatment can also include the use of fire to reduce fuels/or to reduce or enhance riparian vegetation. About 75 percent of those OCFR hand treatment units are found within the Ikes-Wilson subwatershed, just north of the town of Orleans. Twenty-four percent of the hand treatments are within Cheenitch and less than one percent is planned for the Boise Creek watershed. These hand treatments would have little to no risk of sedimentation of adjacent stream channels. No vegetation that provides streambank stability would be treated and only vegetation up to eight inches in diameter would be thinned. Slightly less than half of the hand treatments would occur in plantations and the remaining hand treatments would occur predominantly in early and mid mature stands with some selected hand treatments in late mature and old growth stands were needed.

Table 20. Summary of proposed action alternative treatment acres within riparian reserves

Watershed	Seral Stage	Endline	Hand	Helicopter	Skyline	Total
Boise Creek	Mid Mature		0.26			0.26
	Plantations		2.09			2.09
Cheenitch	Early Mature	0.19	27.21	4.36		31.76
	Late Mature		2.68			2.68
	Mid Mature		41.49			41.49
	Plantations	8.64	35.72		7.04	51.40
Ikes-Wilson	Early Mature	0.46	14.40		0.47	21.31
	Late Mature	0.06	58.24			58.25
	Mid Mature		60.44			71.98
	Old Growth		30.24			30.24
	Plantations	9.03	103.00			112.10
Total		**18.38**	**375.79**	**4.36**	**7.50**	**406.37**

Two units or 7.5 acres of riparian reserves are planned for skyline treatment. These skyline logging systems are proposed within Unit 3 (7.04 ac) and Unit 186 (0.47 ac). Unit 3 is located at the headwaters of Chimmekanee Gulch along FS Road 10N13. The riparian area found in this drainage has an excessive amount of alder and tanoak blow down and/or wind throw creating a heavy amount of down woody material and fuel accumulation. Excess hardwoods associated with this riparian are proposed to be yarded from within 30 feet of the channel. Unit 186 is located off a 350-foot temporary road of Bark Shanty Road near the Reece Homestead. This unit is a dense, vigorous, early mature Douglas-fir stand that averages about 16 inches DBH. The lower portion

of this unit has a small riparian buffer associated with an intermittent channel that flows into Wilson Creek. Both of these skyline units would require full suspension of logs over these existing riparian buffers and front-end suspension in the remainder of the yarding corridors. Mobile swing-boom yarders with rubber tires would be placed on the roadway adjacent to these units to safely yard these trees.

A total of 4.3 acres of riparian treatments are being proposed for helicopter treatment within Unit 27 near Big Rock. This is the only riparian helicopter unit within the OCFR project. This helicopter treatment was identified to minimize disturbance of ground cover and vegetation due to the lack of roads and complex network of seasonally flowing or intermittent stream channels found in the area.

Endline treatments would occur within 18.4 acres of riparian reserves of which 96 percent are plantations. The remaining four percent of endline treatment would occur within early mature stands. Endline logging systems require the use of a winch to pull trees along the ground for distances up to 100 foot to a stationary machine. Selective thinning of riparian vegetation is designed to occur within the outer 80-foot edge of these riparian buffers, as long as ACS objectives are met. This is particularly important in plantations where significant portions were previously harvested.

Underburning and/or firing would be done by backing the fire down the slope to maintain lower flame lengths, generally less than four feet high. Ignition would stop at the edge of the riparian and the fire would be allowed to slowly back down and go out on its own. The intentional ignition of fuels within riparian reserves would be limited to only those instances where ignition is needed to lessen the intensity and damage.

Table 21. Riparian reserve fuel reduction treatments by unit under the proposed action alternative

Riparian Reserve Fuel Reduction Treatment	OCFR Units	Acres
Endline	3,14,17,19, 121, 129, 136, 140, 158, 165, 177,178, 188	19
Skyline	3,186	8
Helicopter	27	4

Table 21 shows which units would have wood extraction to reduce fuel loads within riparian reserves. Of these fuel reduction treatments, the ground-based endlining has the greatest potential for ground disturbance and surface erosion. However, the risk of sedimentation to the riparian reserve is still very low given the fact that: (1) selected endlining occurs only in the outer 80 feet of the riparian reserve leaving a large undisturbed buffer which significantly reduces the risk of sediment delivery, and (2) the total acres of endlining is so small relative to the total acres treated that the amount of potential sediment delivery is extremely limited in size and distribution. Skyline yarding and helicopter yarding within riparian reserves would also have a very low risk to no risk of generating sediment given the minimal amount of ground disturbance within riparian reserves.

Many of the riparian reserves within plantations have lost their true riparian vegetation characteristics due to the high stem density associated with plantations of various ages and the

lack of light that reaches the riparian forest floor. These plantations are of commercial age and selective thinning through use of endlining would greatly benefit reducing the high fuel loads within these riparian areas. It would also return the riparian areas to more natural vegetation conditions and allow more true riparian vegetation to reestablish. Selective thinning through hand, endline, skyline, or helicopter treatments in designated riparian reserves would greatly benefit and facilitate the reestablishment of more natural riparian areas and accelerate the recovery of long-term woody debris recruitment and the proper functioning of the riparian reserves as outlined in the ACS objectives. Under this alternative, approximately 166 acres of riparian reserves in plantations would benefit from selective thinning through increased recovery and growth of conifers that would provide better shade, cover and future large woody debris recruitment.

The riparian buffer width specified in the Six Rivers LRMP for “non-fishing bearing streams” remains as one-site potential tree height or 150-foot slope distance whichever is greatest. The site-potential tree height for the proposed action alternative was delineated as 160 feet on either side of permanently or seasonally flowing stream channels. There were few unstable land features (landslides or soil slumps) within the project boundary and they were avoided and added to the riparian reserves. Management activities within these riparian reserves and their project design features are described in Appendix C. How these proposed treatments meet ACS objectives is described in the Water Quality section of this FEIS. Riparian Reserve buffers of 160 feet on either side of permanently flowing non-fish bearing streams and seasonally flowing stream channels, particularly in the upper headwaters of watersheds (as is the case with OCFR) is more than adequate to protect stream channel processes and functions and water quality from management actions adjacent to riparian areas. These riparian reserve buffer widths combined with the proposed action alternative design criteria provide a solid foundation that would protect riparian processes and functions, water quality and riparian dependent species. Selected site-specific riparian reserve conditions and treatments in plantations and native stands, including riparian reserve unstable features and landslides in Units 196 and 16, are found in the OCFR Riparian Reserve Analysis Specialist Report (Cook, 2008).

Management within riparian reserves must demonstrate how activities would maintain or benefit riparian reserves and meet the ACS objectives (see water quality section for more details on meeting ACS objectives; Figure 16). Implementing treatments that would result in loss of large wood, channel structure, and negatively impact water quality and riparian habitat does not meet the intent of the Northwest Forest Plan. The Northwest Forest Plan recognized the need to manage within riparian reserves to address legacy concerns of old silvicultural practices that encroached or even eliminated large trees within riparian areas and adjacent stream channels

(LRMP, p. IV-110, IV-44). Silvicultural practices must maintain or benefit riparian areas and therefore any treatments must leave the largest trees in tact and thin out smaller trees that result in excess stand densities, high fuel loads, and retard the recovery of the native riparian reserve stand characteristics. Mechanical entry such as tractor logging into riparian reserves would not benefit riparian reserves due to potential for ground disturbance, soil compaction, and sediment delivery. However, selected endlining of smaller diameter trees from the outer edges of riparian reserves (no tractor entry) would result in very low levels of ground disturbance and the remaining 80 feet of undisturbed ground would provide more than adequate buffer to protect water quality from sedimentation.

Figure 16. Unit 195 thinning opportunities within outer edge of riparian reserve

Increased Acres of Fire Resiliency

As shown in Table 19, the fuels reduction treatments within riparian reserves, particularly in older commercial age plantations and early mature stands would result in an increase in more riparian reserves acres having a high and moderate resiliency to wildfire (high = 194 acres and moderate = 66 acres) and a decrease in the riparian reserves acres having a low resiliency to wildfire (148 acres) when compared to no action alternative. The Six Rivers Forest Plan addresses the need to treat riparian reserves and design fuel treatment projects in a manner that recognizes the role of fire in the ecosystem and to ensure that ACS objectives are met (LRMP, p. IV-46). The Forest Plan further recognizes the need to apply silvicultural practices within riparian reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS objectives (LRMP, IV-49).

The main purpose of the OCFR Project is to reduce the risk of future fires adjacent to the community of Orleans. In the upper one-third of the hillslopes where the risk of natural wildfire is the greatest, it is important to treat the entire landscape, which includes portions of riparian reserves. The majority of riparian reserves in the upper hillslope positions have vegetation that are no different from the surrounding upland vegetation and therefore have the same risk of wildfire as the surrounding terrain. The majority of riparian reserves within the project area are small intermittent and ephemeral streams and some small perennial streams that have limited “true riparian vegetation” only within 10 to 40 feet of the stream channel. The remaining vegetation types within rest of the 160 foot riparian reserve buffers (remaining 120 to 150 ft) are composed of drier upland vegetation types. During wildfire events, these types of channels are

frequently burned over as seen in the recent fires such as the Somes, Panther, Sims, Friday and Megram fires on the Six Rivers National Forest. On larger perennial streams such as Donahue Flat, Rosaleno, Mud, and Big Rock Creeks, true riparian vegetation is a larger portion of the vegetation within the 160-foot riparian reserve buffer. Larger perennial streams tend not to burn as frequently or severely in the event of a wildfire as compared to smaller intermittent and ephemeral streams and small perennial streams. In most of these smaller headwater channels, the true riparian vegetation generally recovers quickly after a fire, however the shade from the conifer and hardwood canopy is lost and future woody debris recruitment is altered. Blending upland fuel reduction treatments with adjacent riparian reserves is critical so that the riparian reserves do not become the fuel-wick in the event of a wildfire. Completely excluding fuel reduction treatments within riparian reserves elevates the risk that these areas would concentrate wildfire in the event that wildfire enters adjacent treated stands. Examples of such conditions are evident in Units 143 and 144 where in a previous project (Orleans CPPA), the riparian reserves were left untreated and had the highest density of fuels when compared to the surrounding treated landscape. The highest priority for fuels reduction treatments within riparian reserves is associated with plantations. Riparian reserves within plantations have the highest stem densities and fire risks when compared to riparian reserves in lightly managed or natural stands.

Generally speaking, based on professional observations from post-fire monitoring on the Six Rivers, wildfires that result in low to moderate burn severities in riparian areas tend to result in low to moderate erosion rates within riparian areas and are associated with minor surface erosion and occasional bank instability attributable to loss in root or vegetation control. In contrast, severe wildfires within riparian areas have resulted in gullying of headwater streams and extensive channel banks instability and erosion and complete loss of canopy cover. While wildfire is a natural event that can result in a range of severe to minor erosion rates, the estimated sedimentation associated with the proposed action in comparison with the no action alternative is low, and is anticipated to be less than a low severity wildfire. When the risks of sedimentation associated with the proposed action are compared to a severe wildfire, the sedimentation rates could be an order of magnitude larger (see Water Quality section and Soils and Geology Report, WEPP model).

Cumulative Effects

In assessing cumulative watershed effects for the proposed action alternative, all past, current and reasonably foreseeable actions on both private and public lands were assessed within all affected watersheds and related to beneficial uses and sensitivities within these watersheds (LRMP p. IV-71, 1-10 and 11) (FSH 2509.22 Ch. 20). The cumulative watershed effects analysis and associated assumptions and methods are explored in greater detail in the OCFR Watershed, Water Quality and Fisheries Report - Appendix A. The timeframe for analysis is the past 30 years and into the future 10 years. Appendix A – Map 8 displays the watershed cumulative effects boundaries.

Treated Acres within Riparian Reserves, Large Woody Debris Recruitment, and Increased Acres of Fire Resiliency

The cumulative effects of past management activities such as timber harvesting; road building and fire suppression has resulted in many riparian areas with altered function and processes. Riparian reserves within plantations have had much of their large trees removed, which in turn results in less shade, cover and large woody debris. The high stem densities also result in great fire risk. Fire suppression activities have significantly reduced the amount of fire in riparian areas over the past 50 years leaving high fuel loads in places, which threaten the resiliency of the riparian areas in the event of a wildfire. In addition to these past activities, road building has cut across numerous riparian reserves in multiple locations throughout the project area, which has the potential to alter the sediment routing within the riparian reserve.

As a result of these cumulative actions within riparian areas, there has been impact on selected riparian areas. Of particular concern is erosion and gullying of portions of Mud Creek in Unit 134. This area is still eroding and gullying due to past harvest activities, which removed critical trees that provided channel stability. This erosion and gullying would continue until the channel banks are at a more stable angle of repose and there is sufficient woody debris in the channel to trap the sediment. This process would likely take decades. A wildfire through the headwaters of Mud Creek would add to the cumulative effects through loss of vegetation that provides cover and future large woody debris critical for its recovery.

In summary, proposed riparian reserve treatments would reduce the cumulative impacts of past management activities by accelerating the recovery of vegetation in plantations as well as the providing more fire resilient riparian reserves. The slight potential risk of sedimentation

Conclusion: Accelerate development of old growth in riparian reserves

- *Treat acres within the riparian reserves to reduce fuel accumulations*
- *Increase the acres of fire resiliency in the riparian reserves*
- *Increase acres of large woody debris (LWD) recruitment*

- **No Action Alternative:** As a result of cumulative actions within riparian areas there has been impact on selected riparian areas. Of particular concern is erosion and gullying of portions of Mud Creek in Unit 134. This erosion and gullying would continue until the channel banks are at a more stable angle of repose and there is sufficient woody debris in the channel to trap sediment. A wildfire through the headwaters of Mud Creek would add to the cumulative effects through loss of vegetation that provides cover and future large woody debris critical for its recovery.
- **Proposed Action Alternative**: Riparian reserve treatments would reduce the cumulative impacts of past management activities by accelerating the recovery of vegetation in plantations including the recruitment of large woody debris as well as providing more fire resilient riparian reserves.
  1. Acres treated to reduce fuel accumulations: 406 versus 0 under no action alternative
  2. Acres of fire resiliency: 194 characterized as “High” resiliency versus 90 under no action alternative
  3. Improved acres for LWD recruitment: 166 versus 0 under no action alternative

Concern: *The slight potential risk of sedimentation associated with fuel reduction treatments is outweighed by the reduced risk of an uncontrolled severe wildfire which could potentially result in orders of magnitude of more sediment. Scientific references to support these conclusions are available in the Soils, Hydrology, Water Quality, Fisheries and Riparian Reserve Reports (Snavely 2008, Cook 2008, Cook and Cyr 2008).*

associated with fuel reduction treatments is far outweighed by the reduced risk of an uncontrolled severe wildfire, which could potentially result in orders of magnitude of more sediment. The proposed actions would not result in added detrimental cumulative effects to riparian reserves.

Environmental Consequences to Water Quality/Fisheries

Affected Environment

The OCFR project is located in multiple headwater areas that provide domestic water to residents of the town of Orleans. The OCFR lies within the upper headwaters of small tributaries draining into the mainstem of the Lower-Middle Klamath River (Appendix A – Map 8). The LMK watershed is broken out into three separate subwatersheds or 8th-field hydrologic units for the OCFR project. They are Ikes-Wilson (6,388 acres) to the north, Cheenitch (3,608 acres) and Boise Creek (9,986 acres) to the south. Within each of these watersheds are smaller drainages that provide domestic water to downstream residents such as Mud Creek and Donahue Flat Creek. A large spring exists adjacent to the Pierce property, which serves as their domestic water source. Multiple small springs exist throughout the project area but do not serve as domestic water sources. A more detailed description of the names of the stream channels within the OCFR project area have been described previously in Environmental Consequences to Riparian Reserves above. All of these streams provide domestic water.

Water Quality and Quantity

Water quality of the Klamath River is listed as impaired throughout its length under Section 303(d) of the Federal Clean Water Act. The Klamath River in California is considered impaired due to temperature, excessive nutrients, and seasonally low dissolved oxygen. The Klamath River below Weitchpec is also listed as sediment impaired. The basis for listing the Klamath River as impaired was aquatic habitat degradation due to excessively warm water temperatures and algae blooms associated with high nutrients, water impoundments and agricultural diversions.

While the mainstem Klamath River is listed as impaired due the temperature, excessive nutrients and low dissolved oxygen, the tributaries to the Klamath River within the project area provide excellent water quality to the mainstem Klamath. The LMK watershed analysis (2003) states that the water quality from small tributaries draining into the Klamath River is excellent relative to temperature, nutrients and dissolved oxygen (LMK WA pg 3-88). Stream temperature monitoring data indicate that streams and tributaries within the project area rarely exceed a summer high temperature of 69 degrees F. These tributaries provide cool water that is critical to providing thermal refugia for fisheries within the Klamath mainstem during the peak temperature stresses in July through September. The Klamath mainstem often exceed 80 degrees F and can be lethal for most salmonid species.

In addition to excellent stream temperatures in the tributaries within the project area, nutrient cycling and dissolved oxygen have not been altered by past management activities. There are no large impoundments of the tributary streams within the project area that could increase

temperature and limit aeration (hence dissolved oxygen). The natural cycling of litter and decay from riparian vegetation and surrounding canopy still occur within tributaries in the project area and these processes have not been significantly altered by past management activities. An extensive description of the baseline water quality conditions within the project area for the Boise, Ike-Wilson, and Cheenitch subwatersheds and tributaries are found in the OCFR Fisheries BE/BA.

While the hydrologic regime within the Klamath mainstem has been altered relative to peak and low flow conditions related to operations of the hydroelectric dams, the hydrologic regime within the tributaries remains within its natural range of variability. There are no impoundments or significant water withdrawals beyond limited domestic use. While selected headwater portions of tributaries have experience past logging, these activities have been metered over time and are currently heavily forested, and as such, the evapotranspiration rates have not been altered to where they would influence a change in peak or low flows. Research indicates that more than 20-25% of the basal area must be removed all at once to achieve measurable increases in water yields (Stednick 1996). Increases in annual flows and summer flows are usually associated with a significant decrease in evapotranspiration rates associated with large wildfires, extensive and recent logging (Keppler and Zeimer, 1990), or extensive urban development. None of these conditions have occurred within the project area. A recent study modeled the effects of fuel reduction through thinning and found that there was very little impact on peak discharge, while a catastrophic wildfire would increase the peak discharge by 2 to 6.6 times the historic 100 year peak flow (Leao, D.S. 2005). Forest thinning would result in such small changes to the hydrologic regime that effects would be undetectable by conventional instream flow monitoring methods (Huff et al. 2002).

Sedimentation associated with past road building, timber harvesting activities, and natural landslides due to large storms has elevated the sedimentation regime within some of the small tributaries within the OCFR project area, most notably Whitey's Gulch and Mud Creek. Management-related sediment inputs within Whitey's Gulch have been largely associated with road construction and road failures during large storm events followed by timber harvest. In small sections of the headwaters of Mud Creek, management-related sediment inputs are largely attributable to post logging channel adjustments and gullying.

With the declining health of the Klamath River fisheries, there is a strong need to restore the landscape and watersheds draining into the Klamath River. Past management actions such as timber harvest, road building and fire suppression have altered the natural sediment and wildfire disturbance regimes. The LMK WA assessed the sediment inputs of roads throughout the Klamath corridor and determined that roads are the leading management-related source of sediment. About one-third of all management-related landslides have been associated with state Highway 96, which periodically closes during large winter storm events due to new and reactivated landslides. The LMK WA showed that in the southern portion of the OCFR project area (called Whitey's Gulch in the WA) the sedimentation associated with road-related landslides were greater than for natural landslides (road-related 61 percent and natural 15 percent; LMK WA pg. 3-60). In the

northern and central portions of the OCFR project area (called Ikes Creek in the LMK WA), the reverse was true. In the Ikes Creek area, natural landslides were the leading source of sediment followed by Highway 96, which was the leading input of management-related sediment.

Sediment input from Forest Service road failures within the Ikes Creek area northern and central section of the OCFR project area) was 4.4 percent of the total sediment delivery from 1944 to 1998. According to the LMK WA, timber-harvest-related sedimentation from landslides was largest in the Whitey's Gulch area and not evident in the Ikes Creek area. However, within the OCFR project area, field investigations during summer 2007 indicate that sedimentation impacts associated with past timber harvest activities are limited to the Mud Creek watershed and are associated with stream channel gullies rather than landslides.

There are several small, recently active, unstable areas within the project area: a small soil slump within unit 16 in the southern portion of the project area and a small slide in unit 196 in the northern portion of the project area. These unstable areas are not associated with past logging activities and have been excluded for treatment during the layout process (see selected site-specific riparian reserve treatments are described in Appendix A of the OCFR Riparian Reserve Analysis and Specialist Report pp. 22, 39). The primary mass wasting phenomena found throughout the project area were inner gorge failures associated with past storm events. These areas have been avoided through the riparian reserve buffers. No unstable areas were encountered during road reconnaissance and layout associated with proposed temporary and reconstructed roads.

There is general agreement in published literature that roads have the potential to result in detrimental impacts on aquatic resources (Furniss et al. 1991, Trombulak and Frissell 2000, Madej 2001, Grace and Clinton 2007, Cook and Dresser in press) and that road restoration activities such as road decommissioning and road storm-proofing measures (such as upgrading culverts and installing stream diversion dips) are needed to improve aquatic resources (Madej 2001, Furniss et al. 1997, Furniss et al. 1998, Switaliski et al. 2004). In light of declining Orleans District road maintenance funding, and the potential sedimentation risk associated with roads, a comprehensive analysis of all the Forest Service roads within the Orleans District was undertaken in 2005 to 2007, which resulted in the decision to decommission 200 miles of high risk and low need roads. The remaining 455 miles were to be upgraded for water quality purposes based on priority risk areas (Orleans Transportation and Road Restoration EA 2007). This decision follows the recommendations outlined in the LMK, Red Cap, Blue and Bluff Creek Watershed Analyses. The bulk of the proposed road decommissioning is outside of the OCFR project area where the greatest resource risks and benefits to aquatic ecosystems exist. With the exception of Whitey's Gulch, restoration needs within the OCFR project area are limited and greater opportunities and benefits exist elsewhere as discussed in the Orleans Transportation and Road Restoration EA.

As part of the Orleans Transportation and Road Restoration scoping and NEPA process, public comments were received to keep as many roads within the OCFR project area in order to minimize the need for new road construction associated with OCFR implementation. As such, the Orleans Transportation and Road Restoration EA kept most of the existing roads within the

OCFR project area but still authorized 3.4 miles of road decommissioning on the highest risk roads within the OCFR project area (0.5 miles – non-system road 10N13.4 in Cheenitch Creek, 2.9 miles –non-system roads 10N13.1 and 10N13.2 in Whitey's Gulch). As part of the proposed action alternative, an additional 0.5 mile of road decommissioning in Whitey's Gulch is proposed associated with non-system road 10N13.3.

Road construction associated with new and temporary roads is frequently associated with the implementation of mechanical fuels treatment projects, particularly where large portions of the treatments are ground-based. The building of roads associated with fuel reduction treatments is frequently controversial. The concern is raised that the potential negative impacts of the new roads (e.g., sedimentation of aquatic habitat, fragmentation of wildlife habitat, etc.) outweigh the benefit of the fuels reduction treatments.

An assessment of the watershed impacts of forest treatments to reduce fuels and modify fire behavior was done by Rhodes (2007). Rhodes draws the conclusion that if the intent is to improve watershed condition and aquatic habitat the primary focus should be road restoration activities rather than fuels reduction treatments because the risk associated with roads is larger than the statistical likelihood of a high intensity fire resulting in adverse impacts to riparian areas and water quality. Watershed restoration is a primary focus on the Orleans District as shown by the completion of the Orleans Transportation and Road Restoration EA, which authorized 200 miles of road decommissioning in the highest risk areas with the highest fisheries values. Complementary with the watershed restoration efforts is the need to address recovery of upland health by reducing fuel loads that might result in high intensity wildfires that could negatively impact downstream domestic water sources and aquatic resources. Rhodes (2007) argues that there is a high degree of certainty that mechanized fuel treatment projects will increase erosion and sediment delivery to stream systems with consequent negative impacts on water quality. Rhodes states that much of the erosion from roads is delivered to streams due to direct hydrologic connection via ditches and drainage features, and that mechanical fuel treatment projects will cause damage to riparian areas resulting in the loss of large wood and channel complexity and impact water quality. The implication embedded in Rhodes (2007) is that all mechanical fuel treatment projects will degrade water quality regardless of project design features and implementation of Best Management Practices.

While road construction and mechanized fuel treatments certainly have the potential to impact water quality and riparian areas, these consequences are not a foregone conclusion. Appropriate design features can significantly reduce or even eliminate the risk of water quality impacts. Rhodes (2007) is correct in stating that much of the erosion from roads is delivered to streams due to direct hydrologic connection via ditches and drainage features but he fails to state that if a road is not hydrologically connected to a stream that there is no mode of sediment delivery other than mass wasting. If roads are built in stable areas, on gentle slopes (less than 45 percent), and the roads are not hydrologically connected, then there is little to no risk that the roads will result in water quality impacts. There is simply no delivery mechanism of potential road erosion to water courses. When roads are disconnected from the stream network and not

located in steep or potentially unstable areas, the concerns with new road construction are no longer a water quality issue but rather a concern regarding loss in soil productivity or a wildlife habitat fragmentation concern. The same logic applies to landings and disposal sites. If they are not within close proximity to stream channels (e.g., within riparian reserves) or within potentially unstable areas, the likelihood of sediment delivery and impacts to water quality is very low.

Similarly, it is not a foregone conclusion that mechanical fuel reduction treatments adjacent to stream channels will result in loss of large wood, channel complexity and negatively impact water quality, as stated by Rhodes (2007). As was described in the preceding riparian reserve sections, the standards and guidelines as well as ACS objectives from the Northwest Forest Plan and Six Rivers LRMP provide stringent protection for water quality by ensuring that only activities that benefit riparian reserves can occur.

Fisheries

No resident or anadromous fish bearing streams or designated or proposed critical habitat exist within the OCFR proposed treatment areas. However, the action area is within the range of listed fish species that occupy habitat downstream and maybe affected by activities undertaken with this project. Threatened, endangered, and proposed fish species found within the OCFR project were identified from the National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA) List of June 28, 2005, and the Six Rivers National Forest (SRNF) Administrative Unit List provided by the Arcata Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS) dated February 22, 2008 (see Appendix D in the Watershed, Water Quality and Fisheries Report). Sensitive fish species were identified from the USDA Forest Service – Pacific Southwest Region Sensitive Animal Species List dated October 15, 2007.

NOAA Fisheries identified seven evolutionarily significant units (ESUs) of coho salmon (*Oncorhynchus kisutch*) in Washington, Oregon and California. Each ESU is treated as a separate species under the Endangered Species Act (ESA). The Southern Oregon/Northern California Coast (SONCC) coho salmon ESU is listed as “threatened” and can be found within the analysis area. This ESU includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California, as well three artificial propagation programs: the Cole Rivers Hatchery (ODFW stock #52), Trinity River Hatchery, and Iron Gate Hatchery coho hatchery programs. In addition, designated critical habitat (CH) for this species of coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive (May 5, 1999, 64 FR 24049).

Spring Chinook salmon (*O. tshawytscha*) and steelhead/rainbow trout (*O. mykiss*) are listed as Forest Service sensitive species and also occupy downstream habitat that can be affected by activities occurring within the OCFR action area.

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fishery Act of 1996 (Public Law 104-267; U.S.C. 1801 *et seq*.), and its implementing regulations [50 CFR § 600.920(a)] require that before a Federal agency may authorize, fund or

carry out any action that may affect essential fish habitat (EFH), it must consult with the National Marine Fisheries Service. EFH is defined in Section 3 of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) as "those waters necessary to fish for spawning, breeding, feeding, or growth to maturity." The NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem. EFH has been designated for SONCC coho salmon and the Upper Klamath-Trinity River (UKTR) Chinook and for this project includes all streams, lakes, ponds, wetlands and other water bodies currently, or historically, accessible to these two species, except for areas upstream of certain impassable natural and man-made barriers.

Under the National Forest Management Act (NFMA), the Forest Service is directed to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." (P.L. 94-588, Sec 6 (g) (3) (B)). The 1982 regulations implementing NFMA require that "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR 219.19). Management indicator species (MIS) is a concept used by the agency to serve as a barometer for species viability at the Forest level. Population changes of MIS are believed to indicate the effects of management activities.

The Forest Land Management and Resource Plan for the Six Rivers National Forest uses MIS to assess potential effects of project activities on the various habitats and habitat assemblages with which these species are associated. For the analysis associated with this project, the steelhead/rainbow trout and summer steelhead habitat assemblage were addressed based on the downstream habitat within the OCFR project area.

Anadromous tributary habitat for Chinook and coho salmon, as well as steelhead trout, are limited due to high gradient stream channels, impassable barriers and the lack of suitable habitat found within Donahue Flat/Mud Creek, Rosaleno Creek, Wilson Creek and Chimmekanee Gulch. As a result, the quantity and quality of habitat (both temporally and spatially) within these small tributaries defines the limit for these fish species. The lowermost reach (0.2 mile or less) of these streams provide refuge and remain critical at various times of the year to fish survival based on Forest Service fisheries survey data. Within the OCFR project, the most suitable tributary habitat is found within Boise Creek. Based upon Forest Service habitat and fish surveys performed within the Boise Creek mainstem, bedrock falls located at river mile 3.7 limits passage of anadromous salmonids.

Approximately 11 miles of the Klamath River mainstem also lies within the project boundary between Boise Creek and the Salmon River. This section of the Klamath River is a migration corridor for these fish but also provides fish passage and holding and spawning areas for adults, facilitates movement of juveniles into and between tributaries, provides rearing habitat for fry and juveniles produced in tributaries, and provides habitat for smolts as they emigrate from tributaries and migrate to sea.

The primary measurable indicators used to assess the effects of fuel treatments and associated activities (e.g., roads and landings) on water quality are: (1) the extent of ground disturbance (e.g., miles of road construction, reconstruction, and acres of landing construction and reconstruction) connected to riparian areas, (2) number of stream crossings constructed and removed, (3) acres of ground based fuel treatment types within riparian reserves, and (4) potential sediment delivery (cubic yards).

Ground-disturbing activities such as road construction, reconstruction, or decommissioning, as well as ground-based yarding logging systems have the potential to result in erosion and potentially result in sedimentation of adjacent stream channels. All ground-disturbing activities such as road and landing construction or reconstruction or tractor endlining move and expose soil and create the potential for surface erosion. However, not all soil erosion results in direct sediment delivery. The likelihood of management-related sedimentation and impacts to water quality are predicated largely on the proximity of these ground disturbances to riparian areas and stream channels and slope steepness. Generally speaking, ground-based activities such as endlining are conducted on gentle slopes (less than 35 percent which have a lower potential to mobilize sediment) and combined with equipment exclusions of 160 feet (see Appendix D - Riparian Reserve design criteria), the risk of sediment delivery is very low. The risk of sedimentation associated with endlining is limited to the dragging of individual trees in the outer 80 feet of the riparian reserve, which has a very low risk of sediment delivery. The Six Rivers Best Management Practices Monitoring reports dating back to 2001 show that streamside management zones associated with vegetation treatments has been 100 percent effective in preventing sediment delivery. The greatest risk of sediment delivery is generally associated with stream crossings construction or removal during road construction or road decommissioning and depends on the size and steepness of the stream channel.

With respect to fisheries, the “action area” under the Endangered Species Act (ESA) is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action [50CFR402.02]. For this project, it includes those areas where coho may be directly or indirectly affected by the proposed action. The OCFR project does not overlap with any fish-bearing streams;, however, the action area is within the range of listed fish species that occupy habitat downstream and maybe affected by activities undertaken with this project. The analysis area**,** for purposes of NEPA, includes the action area as well as areas where Chinook salmon or steelhead trout may be directly or indirectly affected by proposed activities. For the OCFR project, the analysis area equates to the action area and effects are analyzed at the 5th- and 8th-field watershed scales. Conclusions regarding the distribution of anadromous fish and their habitat in the project boundary are based upon Forest Service, Karuk Tribe of California, and California Department of Fish and Game data, field review of habitat suitability, and professional judgment (Cyr, Forest Service fisheries biologist).

In defining this area, the following information is factored into the assumptions and analysis for the OCFR project.

- Appendix A - Map 9 displays the relationship between proposed action alternative treatment areas, designated riparian reserves and occupied coho salmon critical habitat. Coho critical habitat is reflected on this map coverage as a "red-dotted" line indicating the current range and distribution of this species. The current range of Chinook and steelhead trout are the same as coho for this geographic area of the OCFR project.
- The proximity of actions associated with the OCFR project related to riparian treatment units and downstream to coho and their habitat are reflected in Table 22. Direct and indirect effects of the proposed action alternative will be determined at the site and distance from anadromous fish and their habitat (whether coho, Chinook or steelhead). Distances range between 0.4 and 2.4 miles at the action level.
- The existing OCFR road network shown in Appendix A – Map 10 displays distance downstream to occupied coho habitat from the main road crossings within Donahue Flat, Mud, Rosaleno, and Wilson Creeks in the north, and Big Rock, Chimmekanee, Cheenitch Gulch and Sunset Springs in the south.

Table 22. Riparian acres for endline, helicopter and skyline treatments and their distance to occupied coho critical habitat under the proposed action alternative

Unit	Seral Stage	Endline	Helicopter	Skyline	Total	Miles to Coho CH
3	Plantations	0.09		7.04	7.13	0.98
14	Plantations	0.32			0.32	2.24
17	Early Mature	0.19			0.19	2.20
17	Plantations	4.09			4.09	2.22
19	Plantations	4.14			4.14	1.15
27	Early Mature		4.36		4.28	0.40
121	Plantations	0.99			0.99	2.10
121	Late Mature	0.07				
129	Plantations	0.90			0.90	2.12
136	Plantations	2.65			2.65	1.92
140	Plantations	0.19			0.19	1.92
158	Plantations	1.97			1.97	2.41
165	Plantations	0.73			0.73	1.89
177	Early Mature	0.39			0.39	2.08
178	Early Mature	0.08			0.08	2.13
178	Plantations	0.88			0.88	2.13
186	Early Mature			0.47	0.47	1.62
188	Plantations	0.70			0.70	1.95
Total		**18.38**	**4.36**	**7.50**	**30.10**	**~0.4 to 2.4 miles**

This information is further explained in a fisheries biological assessment that was prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act [19 U.S.C. 1536 (c)], and follows standards established in the Forest Service Manual direction (FSM

2672.42) (USDA 1991). Data summarized within the *Biological Assessment and Biological Evaluation for Threatened, Endangered, Proposed, and Sensitive Fish Species that may be affected by the Orleans Community Fuels Reduction and Forest Health Project* (2008) can be found in the District project file.

The severity of the effects related to implementing treatments with the proposed action alternative and those that may result from a forest wildfire pose different risks in the short and long term to TES fish and their habitat. The Six Rivers National Forest Tributaries Matrix of Pathways and Indicators serves as the basis to identify and document the current condition of a project watershed and aquatic habitat. Watershed conditions are determined as "properly functioning", "at risk", or "not properly functioning" and are described as "environmental baseline". Expected effects related to environmental baselines for the lower-mid Klamath River (5th-field HUC), and the remaining 8th-field HUCs of Ikes-Wilson, Cheenitch and Boise Creek subwatersheds are summarized in the "Effects Checklists" in the fisheries biological assessment for this project.

Table 23 compares the measurable indictors between alternatives and is described in greater detail by alternative.

Table 23. Water quality indictors for the OCFR project

Measurable Indicators	No Action	Proposed Action
Roads		
Construction/Reconstruction (mi)	0	3.6
# stream crossings	0	0
Acres within riparian reserves	0	0
Estimated Sediment Delivery (yd3)	0	0
Decommissioning (mi)	0	0.5
# stream crossings	0	2
Estimated Sediment Delivery (yd3)	300	15
Landing and Disposal Sites		
Acres of new construction	0	61
Acres within riparian reserves	0	0
Estimated Sediment Delivery (yd3)	0	0
Fuels Treatments		
Acres endlining within riparian reserves	0	22
Estimated Sediment Delivery (yd3)*	28	34
Wildfire (yd3)*	6,050	121

*estimated sediment delivery rates are derived from the WEPP model and are described in the Soils and Geology Specialist Report

Alternative 1 - No Action

Direct and Indirect Effects

Water Quality, Quantity and Fisheries

Under this alternative there would be no fuel reduction treatments including road building or landing construction and therefore no direct and indirect management-related sediment delivery.

Under this alternative, non-system road 10N13.3 would not be decommissioned. In the event of a large storm, there is the risk that the culverts associated with this road would fail and deliver up to 300 cubic yards of sediment. Mid-slope roads within Whitey's Gulch have in the past been associated with landslides that have impacted downstream water quality. Large landslides are associated with non-system road 10N13.2, which is adjacent to road 10N13.3.

Threatened, endangered, or sensitive fish occupy habitat approximately 1.6 miles downstream of FS Road 10N13.3 at the confluence of Whitey's Gulch within the Klamath mainstem. Any failures associated along this 0.5-mile road may cause effects at the site, but would be below what is occurring at baseline and would only occur at a magnitude to cause discountable effects to anadromous fish downstream. Any sediment input resulting from this road is not anticipated to affect the survival, reproduction, or distribution of listed salmonids downstream of the project.

A summary of fire occurrence for this portion of the Klamath Mountain Region is described in the LMK WA and Fuel specialist report (Pfister 2008). Wildfire is certain to occur in fire-adapted forest ecosystems like the OCFR project. However, the unpredictable nature of fire behavior and future occurrence is difficult to predict. Fire history within this landscape shows the prevalence of human-caused fires, both by acreage and number. Most of these incidents are associated along travel routes, especially along Highway 96. In the Klamath Mountains, Skinner (2003) found that the median fire return intervals were twice as long in riparian reserves as in upland sites, suggesting that fires occurred less frequently in riparian areas. Many riparian reserves found within the OCFR project differ from adjacent forest stands in composition, structure, hydrology, microclimate, and fuel characteristics. Some of these riparian areas are uncharacteristically dense in vegetation. Wildfires burning in areas of higher fuel loads with ladder fuels and uniform canopies generally increase negative fire effects to the forest and are more resistant to fire suppression efforts.

There is the possibility that if a high severity wildfire were to occur within the project area that an order of magnitude more sediment would be delivered to stream channels than would occur if fuel treatments were implemented (Table 23). It is always very challenging to predict the level of potential sediment delivery associated with a future wildfire, particularly given the unpredictability of weather patterns. Postfire erosion is affected by geological substrate, severity of the fire, local and landscape impacts to vegetation and soil and precipitation patterns (Moody and Martin 2001). The WEPP model is a tool that estimates the likely sediment delivery for a given hillslope in the event of a low-intensity fire versus a high-intensity fire, all other parameters being equal. The WEPP model indicates that sedimentation rates associated with a high-intensity wildfire are typically an order of magnitude higher than sedimentation rates associated with a low-intensity fire. As such, it is difficult to predict how much sediment might occur in the event of a future wildfire; however, it is likely that some portion of the riparian reserves would be lost in a fire, which would elevate the risk of sedimentation of water courses.

If a wildfire were severe and extensive within the project area under the no action alternative, there could be an increase in peak flows associated with a significant reduction in evapotranspiration rates (e.g. loss in forest canopy cover). On the other hand, if an extensive low

to moderate wildfire were to occur within the project area under the no action, it is unlikely that changes in the hydrologic regime would occur due to a lack of significant change in evapotranspiration rates (extensive portions of forest canopy are not typically lost in a low to moderate fire as compared to a stand replacing, severe fire).

The no action alternative is not likely to adversely affect threatened, endangered, or sensitive fish or their habitat because there would be no direct effects and because project effects would not be detectable within the action area. The no action alternative would not cause change in any of the 18 indicators of aquatic health and watershed condition that serve as proxy for determining indirect effects to anadromous salmonids (see Biological Assessment and Biological Evaluation for Threatened, Endangered, Proposed and Sensitive Fish Species that may be affected by the OCFR Project (Fisheries BA/BE) (Cyr 2008)). Therefore, no indirect effects to anadromous salmonids are expected because of taking no action. The no action alternative would not move the Ikes-Wilson, Cheenitch or Boise Creek subwatersheds closer to their desired condition as recommended in the Six Rivers National Forest LRMP and LMK WA. The no action alternative would not promote attainment of ACS objectives within these subwatersheds.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Water Quality and Quantity

Based upon analysis of direct, indirect and cumulative effects, the proposed action alternative would result in a minor short-term impairment to water quality conditions that would have no measurable effect on domestic water sources. Combined with effects of past, present and foreseeable future actions, the proposed action may result in localized increases in suspended sediment during the first few precipitation runoff events following project activities. However, the proposed activities would not result in cumulative watershed effects that threaten impairment of long-term water quality objectives (see cumulative watersheds effects section below, p. 92). Implementation of project design standards (no new roads through riparian reserves, 90 percent fuel treatments in riparian reserves are hand treatments) and use of specific erosion and sediment control measures through best management practices are incorporated in the proposed action. The proposed action alternative complies with the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board waiver (Order No. R1-20044-0015).

Under this alternative, a total of approximately 3.6 miles of road would be constructed or reconstructed (1 mile new temporary road construction, 1.7 mile temporary road reconstruction, and 0.9 permanent road reconstruction). None of the new road construction or reconstruction associated with proposed action alternative is hydrologically connected to the stream system. The new roads do not cross any stream channel or riparian reserve (Table 23). Road construction is well away from riparian reserves and/or located along or beside ridgelines. As such, there is no new risk to stream channels, aquatic resources, and domestic water sources from the proposed

new road construction and reconstruction. The average temporary road length proposed is 0.1 mile long (530 feet) and these roads would be decommissioned after project completion. The majority of the riparian reserve treatments are hand treatments, and combined with the reasons described above, there will be little to no measurable affect on water quality or quantity. Proposed vegetation treatments throughout the project area are of such small extent (e.g. thinning versus clear cuts) that changes to water quantity relative to peak and low flows will not be measurable or detectable. There is a very low to no risk of sedimentation of stream channels associated with road reconstruction or reconstruction activities associated with proposed action alternative. Likewise, there is a very low to no risk of sedimentation of stream channels associated with the construction and reconstruction of landings and disposal areas since these sites are not located within riparian reserves.

The greatest risk of sedimentation is associated with the proposed road decommissioning of non-system road 10N13.3. There are several small stream crossings within this road segment and road decommissioning activities such as outsloping inboard ditches and removing stream crossings would result in downstream sedimentation. An estimated 300 cubic yards of fill would be removed from the stream crossings which would result in approximately 15 cubic yards of sediment delivery associated with channel disturbances and post-treatment channel adjustment. The sedimentation effects are considered short-term impacts (1-3 years; Cook and Dresser 2004).

Sediment delivery associated with the fuels treatments is estimated to be 34 cubic yards based on the WEPP model (see Table 23 and also Soils and Geology Report). This includes sediment delivery associated with ground disturbance (tractor endlining) and follow-up fuels treatments such as pile burning and underburning within and adjacent to riparian reserves. The WEPP model is known to overestimate erosion and sediment delivery. The estimated sediment delivery from the WEPP model is best used as a comparative tool among alternatives rather than as an absolute number or estimate of sediment that would actually be delivered. The WEPP model indicates that there would be potentially a 17 percent increase in sediment delivery over background associated with fuel reduction treatments. Typically, the potential for sediment delivery is largest the first year following treatments and declines rapidly in the years following as surface cover is reestablished. While the WEPP model estimates that there would be 17 percent increase of sediment delivery over background levels associated with the fuel reduction treatments, past BMP effectiveness monitoring indicates that there has been little to no sediment delivery associated with past fuels and vegetation treatments on the Six Rivers (2001 to 2007 Six Rivers BMP reports available upon request). The results of the WEPP model should therefore be considered as a worst-case scenario relative to sediment delivery and realize that actual observed delivery of sediment associated with past fuel treatments is likely considerably less and not measurable.

It is always very challenging to predict the level of potential sediment delivery associated with a future wildfire, particularly given the unpredictability of weather patterns. The WEPP model indicates that sedimentation rates associated with a high intensity wildfire are typically an order of magnitude higher than sedimentation rates associated with a low-intensity fire. For the Klamath and Six Rivers National Forests, recent fire history indicates that approximately 10 to 15

percent burn with high fire intensities and the majority at low fire severities. It is important to note, however, that recent fires have been actively managed to suppress the spread of fire and in the event that fire suppression resources are not available, there is a greater likelihood that the extent of high-severity fire would increase from that of the recent fires. In the event that a future wildfire occurs within the project area and assuming that all fuel reduction treatments have been implemented under the proposed action alternative, there is a greater probability that the risk and extent of high-severity fire would be reduced when compared to no treatments at all under no action alternative. With a reduction in acres impacted by high severity fire, there would be a reduction in sedimentation rates. In other words, when compared to the no action alternative, there is a greater likelihood under proposed action alternative that there would be fewer acres of high fire severity and a greater probability of less sediment delivery.

In summary, there is a high confidence that potential sedimentation of stream channels associated with proposed action alternative would be very small and not measurable based on the fact that: (1) proposed new road construction and reconstruction are not hydrologically connected and are outside of riparian reserves, (2) the bulk of direct sediment delivery would be associated with the decommissioning and culvert removal on road 10N13.3, (3) the majority of riparian reserve treatments are hand treatments (93 percent), and (4) riparian reserves would have very limited ground disturbance associated with endlining (18 acres total or less than five percent) in the outer 80 foot of the riparian reserve.

Fisheries

Project activities are about ½ mile or more from stream reaches used by anadromous salmonids as described in Table 19 (other than log hauling on a maintained paved road, which generally does not increase sediment delivery to fish habitat). Therefore, there would be no direct effects to salmon or steelhead from implementing proposed action alternative.

Evaluation of indirect effects to anadromous salmonids in the Fisheries BA/BE report was made by first establishing conditions of key indicators of aquatic habitat health and watershed condition in the areas that could be potentially affected by the proposed action, and then determining how these key indicators would change or not change in the short term and long term if the proposed action is implemented. Eighteen key indicators serve as proxy for indirect effects to anadromous fish outlined in this document.

In the Fisheries BA/BE report, it was determined that the proposed project may have slight short-term negative effects to stream turbidity and substrate. A few hazard trees along roads may be felled within stream buffers for public safety or drainage structure concerns, but they would be left on site within the riparian reserve. A slight increase in sedimentation may impact the immediate footprint of the project location and a short distance of channel downstream of the site, with effects diminishing further downstream of the treatment unit. As discussed in this section, some short-term increases in sediment and turbidity are expected from project activities, however, due to the limited amount of sediment that could enter streams, stream mixing, dilution and

material sorting, increases in sediment and turbidity would be insignificant by the time it reaches occupied coho, Chinook or steelhead habitat found a distance downstream.

Also, minor increases in sediment and turbidity to instream habitat and fish are only expected to be short term, since most project-related sediment would likely mobilize during the initial high flow event the following winter season. The physical and temporal separation between project activities, the proximity of stream crossings to downstream habitat, the low probability of sediment moving off site and into streams, and the project design features that would be implemented, minimize the risk of adverse effects to these fish species or their habitat. In summary, any minor sediment input resulting from OCFR project activities is not anticipated to affect the survival, reproduction, or distribution of listed salmonids downstream of the project area.

Cumulative Effects – Alternative 1 and 2

In assessing cumulative watershed effects for the OCFR project, all past, current and reasonably foreseeable actions on both private and public lands were assessed within all affected watersheds and related to beneficial uses and sensitivities within these watersheds (LRMP p. IV-71, 1-10 and 11) (FSH 2509.22 Ch. 20). The cumulative watershed effects analysis and associated assumptions and methods are explored in greater detail in OCFR Hydrology, Water Quality and Fisheries Assessment Report -Appendix A (Cook and Cyr 2008). The following discussion is a summary of the information in the report.

Equivalent Roaded Acres

The ERA method portrays changes to hydrologic response of a watershed (runoff yield, and peaks) due to management impacts. The method normalizes each activity or feature to an equivalent road acre per acre of activity.

Spatial and Temporal Scope of Cumulative Watershed Analysis

Water Quality

All watersheds affected by the project were assessed for cumulative watershed effects at multiple watershed scales including the largest watershed area (HUC6) and the smallest watershed area (HUC8). The HUC 8 watershed area tends to magnify the ERAs and cumulative watershed effects.

The project areas overlap the Ikes-Wilson watershed to the north, and Cheenitch and Boise Creek watersheds to the south and are shown in Appendix A – Map 8. All past, present, and reasonably foreseeable management activities were assessed which include timber harvest activities, and roads on both private and public lands. Timber harvesting activities dating back to the late 1970s were considered in the CWE analysis including the recently implemented Hazel Project and recent fuels treatment projects such as Orleans Community Protection Project A (Orleans CPPA). Recent wildfires within the project area were also included such as the Wilder Fire.

Beneficial Uses and Key Physical and Biological Parameters

There are many beneficial uses of water within the Klamath River and in the Ikes-Wilson, Cheenitch and Boise Creek watersheds (see fisheries section for more details). Impacts to beneficial uses such as resident and anadromous fish can sometimes result from upslope land management activities (e.g., roads, timber harvest) by increasing sediment delivery rates, altering the timing and quantity of water, and impacting riparian areas by altering channel morphology. Other activities such as mining and OHV use can have impacts to water quality. However, there is no active mining within the affected watersheds and the extent of illegal OHV use is not known but is limited due to the steepness of the surrounding terrain.

Cumulative Watershed Effects ERA Model

Threshold of Concern

The threshold of concern, expressed as a percentage of the total watershed area under assessment, gives a limit to the amount of land use activity before significant effects might be manifested downstream.

In order to assess the potential for the OCFR project to result in added cumulative effects, the extent of road miles and acres of timber harvest, including wildfires within all affected watersheds were assessed. These impacts were assessed using the Region 5 Equivalent Roaded Acres (ERA) Model which is designed to be an initial red flag for earth scientists to determine whether past and present land management activities in a given watershed approach or exceed a threshold of concern (TOC) whereby changes in peak flows and hence sedimentation rates might occur. Where ERAs approach or exceed a given watershed's TOC, further field work would be necessary to ascertain whether cumulative watershed effects are present and if land management activities would adversely add to those effects and result in detrimental impacts to beneficial uses.

The ERA methodology has both strengths and weaknesses. Strength of the ERA methodology is the ease with which the analysis can be duplicated and understood. It is also a CWE model that incorporates rates of land management disturbance and recovery times associated with those disturbances, an attribute which is missing in many other CWE analysis models. A weakness of the ERA CWE model is that it is mostly an office exercise, based only on management-related hillslope disturbance. It does not directly assess physical or biological processes in stream channels, nor does it account for the time lag associated with routing sediment delivered from a given activity. Recovery times in the ERA model apply only to the site of a given treatment, not to the recovery of downstream impacts.

Cumulative Watershed Effects Findings

Boise, Cheenitch, and Ikes-Wilson watersheds are well below the threshold of concern indicating that there is extremely low risk relative to past cumulative watershed effects and for added detrimental cumulative watershed effects associated with the proposed action alternative (Table 23). None of the alternatives assessed indicate that adverse significant cumulative effects would occur as a result of fuel reduction and forest health activities within the three affected watersheds. There are very small differences among the alternatives relative to ERA values, with no action

alternative having the least effects, followed by proposed action alternative (see Table 24 and Table 25).

Table 24. Equivalent roaded acres in the OCFR project area by the no action and proposed action alternatives

Watershed	No Action	Proposed Action
Boise Creek	40 (0.6% ERA)	45 (0.7% ERA)
Cheenitch	38 (1.1% ERA)	57 (1.6% ERA)
Ikes-Wilson	90 (1.4% ERA)	139 (2.2% ERA)

Field inventories within affected watersheds corroborate the ERA model estimation of low risk of cumulative watershed effects and indicate that timber harvest activities show few legacy impacts. This observation is corroborated by the landslide assessment in the LMK WA (2003) for the Ikes-Wilson watershed. Field investigations in the riparian areas associated with old timber sales and proposed fuels reduction treatments within the OCFR project area revealed limited legacy effects from timber harvesting relative to sedimentation (see OCFR Riparian Reserve analysis and Specialist Report). The exception was a small selected headwater portion of Mud Creek where active gullying and erosion still occur. The sediment associated with this gully is locally significant but when compared to the sediment delivery from a natural landslide lower in the Mud Creek watershed, the sedimentation amounts are minor. No increased erosion or peak flows within the Mud Creek watershed associated with proposed activities are likely. The activities that resulted in the channel gullying and erosion in selected portions of the headwaters of Mud Creek were attributable to the past removal of old growth trees that controlled channel integrity. All vegetation that controls banks stability is excluded from fuel reduction activities (see project design features). No heavy equipment would enter any riparian reserve and only selective thinning and endlining would occur in the outer edges of the riparian reserve in Unit 129 which is an extremely small portion of the Mud Creek watershed and not within proximity to the sensitive portions of Mud Creek where the gullying is occurring. Only hand treatments would occur within the sensitive portions of Mud Creek. No added adverse impacts to Mud Creek are anticipated as a result of proposed activities.

Table 25. Cumulative watershed effects and percent equivalent roaded acres compared to the threshold of concern

Watershed	Current Condition	Proposed Action	Future Actions	Total ERAs	Threshold of Concern (% TOC)
Boise	40 (0.6% ERA)	5 (0.06% ERA)	0	45 (0.7% ERA)	13.7%
Cheenitch	38 (1.1% ERA)	19 (0.5% ERA)	0 (0% ERA)	57 (1.6% ERA)	14.5%
Ikes-Wilson	90 (1.4% ERA)	49 (0.8% ERA)	0 (0% ERA)	139 (2.2% ERA)	12.0%

In conclusion, based upon analysis of direct, indirect and cumulative effects, the proposed activities would result in a minor short-term impairment to water quality conditions. Change in peak flow conditions is highly unlikely given that the total ERAs are so far below the Threshold of Concern. Combined with effects of past, present and foreseeable actions, the proposed action may result in localized increases in suspended sediment during the first few precipitation runoff events following project activities. However, the proposed activities would not result in adverse added cumulative watershed effects that threaten impairment long-term water quality objectives. Proposed road construction activities are extremely limited and are not hydrologically connected (e.g., do not cross streams or riparian areas and do not involve culvert construction). Recovery of soil surface cover would occur rapidly through leaf fall and needle cast soon after the first fall following implementation of project activities. Implementation of project design standards and use of specific erosion and sediment control measures through best management practices are incorporated in the proposed action. The proposed action complies with the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board waiver (Order No. R1-20044-0015).

Fisheries

The no action alternative would cause no *direct, indirect, or cumulative effects* on anadromous fish. Quality of aquatic habitats would continue to improve very slowly over the long term as watershed conditions gradually improve. The risk of intense widespread wildfire could elevate CWEs beyond the threshold of concern and it would remain high in the short term and long term.

The proposed action alternative would not result in any *direct* effects to anadromous fish. Minor site-scale effects from the proposed action alternative would not change any of the key indicators of aquatic habitat that serve as proxy for *indirect* effects to anadromous fish in the short term or long term. *Therefore, anadromous salmonids and their "critical habitat" and "essential fish habitat" found downstream from the nearest project action would not be adversely affected.* Treatments in the proposed action are expected to lightly increase ground disturbance and CWE in the short term, and slightly decrease risk of adverse effects from high CWEs (from current condition) in the long term by making the subwatersheds more resilient to stochastic events (such as wildfire), by improving forest stand condition on upslope areas, and by improving riparian structure and functioning benefiting aquatic and riparian-dependent species. The combined effect of the proposed action, recent and reasonably foreseeable road decommissioning, and recent and probable future fuel treatments on private lands, are not expected to increase CWE beyond the threshold of concern in these project subwatersheds. The proposed action alternative would be *cumulative* with past actions and would increase ERAs slightly (less than 2.2 percent) in the project subwatersheds in the short term, and remain significantly below threshold for adverse watershed effects. Therefore, cumulative effects are not likely to affect coho, Chinook or steelhead and their habitat.

Conclusion: Water Quality and Fisheries

- *Attainment of Aquatic Conservation Strategy Objectives*
- *Effects determination*
- *Critical habitat and Essential Fish Habitat*

- **No Action Alternative:** The no action alternative would not promote attainment of ACS objectives within these subwatersheds, however, is not likely to adversely affect threatened, endangered, or sensitive fish or their habitat because there would be no direct effects and because project effects would not be detectable within the action area.
- **Proposed Action Alternative**: The proposed action alternative would enhance ACS objectives by accelerating the recovery of vegetation in plantations including the recruitment of large woody debris as well as providing more fire resilient riparian reserves. The propose action is not likely to adversely affect threatened, endangered, or sensitive fish or their habitat. The proposed action alternative would not result in any direct effects to anadromous fish. Minor site-scale effects from the proposed action alternative would not change any of the key indicators of aquatic habitat that serve as proxy for indirect effects to anadromous fish in the short term or long term. Therefore, anadromous salmonids and their "critical habitat" and "essential fish habitat" found downstream from the nearest project action would not be adversely affected.
- **Concern**: *Sedimentation of stream channels associated with proposed action alternative would not be measurable based on the fact that: (1) proposed new road construction and reconstruction are not hydrologically connected to streams and are outside of riparian reserves; (2) the bulk of direct sediment delivery would be associated with the decommissioning and culvert removal on road 10N13.3; (3) the majority of riparian reserve treatments are hand treatments (93 percent); and (4) riparian reserves would have very limited ground disturbance associated with endlining (18 acres total or less than five percent) in the outer 80 feet of the 160 foot riparian reserve.*

Other Required Disclosures for Water Quality/Fisheries

Management Indicator Species

A management indicator species (MIS) analysis was completed for the proposed action. rainbow/steelhead trout and summer steelhead are the fish species that were assessed for the river/stream association. Potential impacts to MIS would be minimized through the adherence of LRMP standards and guidelines for riparian reserves, snags/down woody debris, ground disturbance, revegetation of disturbed areas, and maintenance of existing stand canopy closure.

Any minor sediment input resulting from the OCFR project is not anticipated to appreciably affect steelhead/rainbow trout or summer steelhead MIS due to their distance downstream of the project treatment areas. *Aquatic habitat conditions for these subspecies are not likely to be adversely affected by implementation of the proposed action. The OCFR project would not adversely impact MIS or affect MIS fisheries viability*.

Aquatic Conservation Strategy

The Forest Plan requires that all projects demonstrate compliance with the Aquatic Conservation Strategy (ACS) objectives that were set forth in the Northwest Forest Plan. The following section explains how this project would specifically comply with that direction.

1. *Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.*

   Many acres of riparian stream habitat were altered as a consequence of past harvest activities. The LMK Watershed Analysis (US Forest Service 2003) shows that large portions of the riparian areas around the community of Orleans have been previously harvested and an even larger percent of riparian areas have a high or very high fire risk. Treatments proposed within the riparian reserves are designed to reduce excess fuel loads, particularly in plantations to both accelerate the recovery of large trees and future large woody debris as well as make the riparian reserves more resilient to wildfire given the fire suppression history. The majority of proposed fuel treatment projects within riparian reserves are hand treatments (93 percent) to thin trees less than 8 inches in diameter followed by pile burning during the wet season. Limited selected thinning of trees through endlining, skyline, and helicopter yarding would occur within riparian reserves (7 percent of the time or within 30 acres). The proposed action would both maintain and restore the distribution of trees, and thus habitat complexity across these watersheds. Fuel treatments would help maintain the distribution, diversity, and complexity of watershed and landscape-scale features.
2. *Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.*

   Past timber harvest activities reduced connectivity for a number of riparian-dependent species. The proposed action helps protect future connectivity through accelerating the growth of large trees in plantations and early mature stands through selective thinning and improving the resiliency of the riparian areas and adjacent landscapes in the event of wildfire.
3. *Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.*

   Riparian reserve and water quality design features protect the existing physical integrity of the aquatic system by keeping all ground-disturbing activities well away from channel banks and riparian vegetation (no mechanical entry of heavy equipment within riparian reserves), while allowing implementation of work that protects the future physical integrity of the aquatic system within and adjacent to project units (e.g., 93 percent hand treatments and 7 percent endline, skyline, and helicopter treatments).
4. *Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

   The proposed action maintains water quality. The majority of proposed treatments within riparian reserves are hand treatments that would result in more fire resilient riparian areas and

would result in little to no sedimentation of adjacent headwater stream channels. No heavy equipment would enter riparian reserves. Selective thinning through use of endline, skyline and helicopter yarding would occur on 30 acres or seven percent of the riparian reserves to restore riparian stand characteristics that have been altered due to past harvesting and past fire exclusion. In addition, no new road construction or reconstruction would occur that involves a stream channel or riparian area. Existing conditions for temperature, nutrients and dissolved oxygen are excellent within the stream channels and tributaries in the project area and would be unaffected by the proposed action. Canopy cover associated with treatments in outer 80 foot riparian reserve of natural stands would be greater than 60 percent and within plantations would be 40 to 60 percent in the outer 80 feet of the riparian reserve. Fuel treatments that lightly change the canopy cover will not influence existing stream temperatures or nutrient cycling. Water quality would remain within the range that maintains the integrity of the aquatic and riparian communities.

5. *Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage, and transport.*

   The proposed action would maintain the sediment regime under which aquatic ecosystems evolved. Off-site delivery of sediment into adjacent stream channels is highly unlikely due to the precautions in designing treatment units. Tractor logging is limited to gentle slopes and the majority of riparian reserve treatments are hand thinning. Riparian reserve widths are 160 feet on either side of stream channels, which provide an adequate buffer to prevent any potential erosion from adjacent stand treatment from entering adjacent stream channels. There would be no entry of heavy equipment into riparian reserves and no new road construction or reconstruction would occur that involves stream channels or riparian areas. Thinning treatments that involve endlining of selected trees would only occur in the outer edges of the 160-foot riparian reserve buffer. Unstable lands within the project area have been assessed, excluded from treatment, and added to the no treatment sections of riparian reserves.

6. *Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.*

   The proposed action would maintain the timing, magnitude, duration and spatial duration of in-stream flows. Peak flows and low flows would not be altered. Selective thinning treatments outside and within riparian reserves would not have measurable effects on instream flows. Evapotranspiration rates would not be substantially altered by thinning nor would there sufficient ground compaction to alter rates of surface runoff due to the application of standards and guidelines limiting tractor to 15 percent of unit treatment areas.

   The purpose of thinning within riparian areas is to accelerate the recovery and growth of large trees which have been removed in many areas associated with past harvest activities. There is a need to accelerate the growth of large trees in plantations in order to recover the patterns of sediment and wood routing that are a critical function of headwater stream

channels. There is also a need to ensure that the riparian areas are resilient in the event of a wildfire and that fuel loads within riparian reserves are not excessively higher than those in the adjacent landscape. By feathering and blending riparian reserve treatments with those in adjacent stands, the entire landscape would be more resilient to wildfire and would have a greater likelihood of maintaining watershed conditions and instream flows within the natural range of variability.

7. *Maintain and restore the timing, variability, and duration of floodplain inundation and water table in meadows and wetlands.*

   The proposed action protects water tables in meadows and wetlands. These areas are buffered and heavy equipment is excluded.

8. *Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.*

   The proposed action would maintain or improve the thermal regulation of riparian reserves by accelerating the growth of larger trees in plantations through selected thinning of excess fuels. Fuel reduction treatments would not alter surface erosion rates nor result in bank erosion or channel migration such that the physical complexity and stability of the stream channel would be adversely affected. Vegetation within the break in slope and associated with bank stability would not be treated. Fuel reduction treatments such as thinning within riparian areas, particularly within plantations would accelerate the recovery and growth of future large woody debris that is an essential component of the physical complexity and stability of stream channels.

9. *Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.*

   The proposed action would maintain habitat for riparian dependent species. Recovery of habitat components preferred by certain species would take many decades, particularly in plantations.

Critical Fish Habitat

Designated Critical Habitat (CH) for coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive (May 5, 1999, 64 FR 24049) and includes accessible reaches found on the Orleans Ranger District of the SRNF. A complete species account and habitat description is provided in the *Biological Assessment and Evaluation For Threatened, Endangered, Proposed, and Sensitive Fish Species that may be affected by the Orleans Community Fuels Reduction and Forest Health Project* (April 2008).

Direct effects to SONCC coho salmon and SONCC coho salmon Critical Habitat are not expected to occur. There are no aspects of the project that will occur where coho or their habitat

exist. Analysis of the effects of the Project Elements on the habitat Indicators has found insignificant negative effects related to the *proximity* of SONCC coho salmon and SONCC coho salmon Critical Habitat, so after additional factors were evaluated, and it was determined that the action was negligible or of a very low *probability* of having an impact and that the *magnitude* of impact would be insignificant. Therefore, activities associated with implementation of the OCFR Project *"may affect and are not likely to adversely affect"* SONCC coho salmon and their Critical Habitat.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fishery Act of 1996 (Public Law 104-267; U.S.C. 1801 *et seq*.), and its implementing regulations [50 CFR § 600.920(a)] require that before a Federal agency may authorize, fund or carry out any action that may affect Essential Fish Habitat (EFH), it must consult with the National Marine Fisheries Service. EFH is defined in Section 3 of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) as "those waters necessary to fish for spawning, breeding, feeding, or growth to maturity." The NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem. A complete species account and habitat description is provided in the *Biological Assessment and Evaluation For Threatened, Endangered, Proposed, and Sensitive Fish Species that may be affected by the Orleans Community Fuels Reduction and Forest Health Project* (April 2008). The OCFR Project may affect EFH for SONCC coho salmon or UKTR Chinook salmon, but would not adversely affect SONCC coho salmon or UKTR Chinook salmon EFH. This is due to the potential for an increase in turbidity reaching EFH. However, pulses of sediment would be short term and would be at low levels that it would not adversely affect SONCC coho salmon or UKTR Chinook salmon EFH. Beneficial actions to aquatic habitat by the OCFR Project will yield long-term improvements by improving ecosystem health and functioning, increasing resilience to stochastic events, promoting native vegetation, improving the existing road network and promoting future LWD recruitment. Benefits include lowered risk of severe fire and associated watershed impacts, such as surface erosion, landsliding, loss of riparian vegetation, channel sedimentation, and altered flow regimes.

Compliance with the North Coast Basin Plan

The Basin Plan for the Klamath River contains water quality objectives, implementation plans for meeting those objectives, and other policies of the State Water Quality Control Board and the Federal Government, which are applicable to fuel treatment projects. The water quality standards in the Basin Plan that most closely apply to this project are sediment, turbidity, temperature and dissolved oxygen.

The standard for sediment states that sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. The standard for turbidity states that "turbidity shall not be increased more than 20 percent above naturally occurring background levels". Relative to water temperature, the Basin Plan states water temperature of receiving water bodies shall not be altered and at no time shall the temperature of any cold water be increased by more than 5 degrees F. Similarly, dissolved oxygen concentrations shall not fall below 6.0 mg/l.

Temperature and dissolved oxygen would not be altered as a result of the proposed action. Extensive 160 foot riparian reserve buffers on each side of small head water channel with limited proposed treatments (93 percent hand treatments) would protect stream temperatures. Current dissolved oxygen concentrations are in natural concentrations and would not be altered.

Considerable effort was made to reduce the risk of sedimentation and turbidity relative to the proposed action. The Basin Plan states that controllable water quality factors shall not cause further degradation of water quality when it has already been established as degraded, and efforts to restore the impaired beneficial uses of these watersheds must be made. Given this status, any actual or potential discharges from project actions that are not "reasonably controlled" are considered to be adverse to the beneficial uses and in violation of Basin Plan direction.

Controllable water quality factors include minimizing new road construction, removing any temporary roads at the completion of the project, and emphasizing yarding logging systems such as skyline cable or helicopter that minimize disturbance. Additional measures to mitigate water quality impacts should be included such as restoration treatments that decommission or upgrade roads and erosion control at actively eroding or unstable sites.

In designing site-specific fuels reduction prescriptions for this project, considerable attention has focused on water quality concerns and the need to minimize delivery of management-related sediment. All controllable water quality factors were incorporated into project designs features (see OCFR Project Riparian Reserve Analysis (Cook 2008).

- Only small amounts of new temporary road construction are proposed with the average road length approximating 0.1 mile long (total new temporary road proposed is 0.9 mile). Road reconstruction on existing alignments would occur on 2.6 miles.
- No stream crossings or riparian reserves would be affected by proposed temporary road construction and reconstruction, nor are these roads located in unstable ground. All temporary roads would be closed again after the completion of the project and returned to their condition prior to the project.
- Riparian reserve treatments are extremely limited. Roughly 93 percent of the proposed treatments in riparian reserves are hand treatments followed by pile burning. Approximately five percent of the treatments would be implemented through endlining (22 acres) and only in the outer 80 feet of the riparian reserve, well away from the stream channel.
- Fuel treatments are designed to minimize further impacts to soils by burning under wet weather conditions and only after soils have become moist or wet.

- Stream temperature will not be altered. Canopy cover within 80 feet of the stream channel would not be altered and only selective thinning would occur within the outer 80 feet of the 160 foot riparian reserve buffer on either side of the stream. Canopy cover in mid mature stands and older would not be altered. Canopy cover in early mature stands would be greater than 60 percent. Canopy cover in plantations in the outer 80 foot buffer would be 40 to 60 percent and would not be altered within the 80 feet closest to the stream.
- There is minimal risk of sedimentation and turbidity associated with wet weather operations due to the application of the Wet Weather Operating Standards. In addition, under the proposed action, units that could be wet weather logged would only apply to a few skyline units with roads that are rocked. No ground based logging or use of temporary roads would occur under wet weather conditions, and many ground based systems would cease at the end of August to reduce the risk of spreading blackstain root disease.
- All applicable best management practices would be employed to protect on-site water quality (see Soils and Geology Specialist report for complete list of best management practices (Snavely 2008))
- Due to the small amounts of sediment that potentially would be generated from fuel treatments within riparian reserves, there should be no detectable change in the amount of stream sedimentation or the degree and duration of turbid conditions. Whatever small fraction of sediment that actually reaches a stream would certainly be well below the 20 percent above background threshold as outlined by the North Coast Water Quality Control Plan. The proposed action complies with the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board Waiver (Order No. R1-20044-0015).
- The proposal to decommission non-system road 10N13.3 (0.5 mi) under proposed action alternative further adds to the overall restoration of watershed health in southern portion of the OCRF project area. Extensive restoration planning and implementation has been conducted throughout the Orleans Ranger District (US Forest Service, Orleans Transportation and Road Restoration Environmental Analysis 2007). Additional priority work identified for the OCFR project area includes decommissioning non-system roads 10N13.1, 10N13.2 and 10N13.4 (3.4 mi).
- A cumulative watershed effects analysis reveals that water quality and beneficial uses would not be adversely impacted and the project would not result in added detrimental cumulative watershed effects.

Environmental Concerns Regarding Wildlife Species

Affected Environment

The Orleans Community Fuels Reduction and Forest Health Project (OCFR) planning area is 9,840 acres and lies within the upper headwaters of small tributaries draining into the mainstem

of the lower-mid Klamath River. The lower-mid Klamath watershed is broken out into three separate subwatersheds for the OCFR project. They are Ikes-Wilson (6,388 acres) to the north, Cheenitch (3,608 acres) and Boise Creek (9,986 acres) to the south.

Past management actions such as timber harvest, road building and fire suppression have altered the natural disturbance regimes. The LMK Watershed Analysis (LMK WA, 2003) states that the main factors that have affected most of the wildlife species of concern stem from two main ecosystem processes or management practice: (1) changes to the historic fire regime, and (2) stand-regeneration logging of older forest stands. Currently, there are 721 acres (7.3 percent) of suitable habitat for late-successional habitat species such as the northern spotted owl (NSO) in the planning area.

Commercial silvicultural treatments proposed for this project are expected to provide long-term benefits through the accelerated development of late-successional habitat in young stands. As stands develop, the acres of suitable habitat should increase. The desired canopy closures and associated understory conditions will assist in the developing habitat to be resilient to large scale fire disturbance and provide connectivity of habitat. Other treatments, such as precommercial thinning, will also accelerate stand development. Early seral vegetation is highly susceptible to loss in a fire. Treatments that reduce the time stands are in early seral stages should reduce the risk of loss in the future.

Currently, the affected watersheds are categorized as having a high risk of catastrophic or stand-replacing fire. Existing late successional habitat is at risk. This project will reduce fuel loads that could result in high intensity wildfires that could negatively impact suitable wildlife habitat. Implementation of this project would provide a mosaic of landscapes that increase reproductive, forage, and dispersal habitats for numerous species including threatened, endangered, and Forest Service sensitive species (TES), management indicator species (MIS), survey and manage species (S&M) and neotropical migrant species (NTM).

Older forest contains multiple structural layers with gaps, large snags, large down woody debris, and highly variable understories. Such habitat provides nesting and roosting habitat for late-successional habitat species such as the NSO. Due to past management practices; five of the eight historic NSO territories are currently deficit in suitable nesting and roosting habitat. Thinning would result in the establishment of hardwoods and a multi-story canopy in the even-aged conifer stands. Multi-forest canopy structures are needed for reproductive success of the NSO as well as many MIS and other wildlife species, such as survey and manage species and neotropical migrant species. Implementation of this project would accelerate habitat characteristics necessary to improve the habitat for these species in the long term.

The cumulative effects boundary for wildlife species is given in Appendix A – Map 11.

Threatened, Endangered and Forest Service Sensitive Species

Direct, indirect and cumulative effects to TES are disclosed in the Biological Assessment/Biological Evaluation (BA/BE) for the OCFR Project, (located in the project file) and the results are summarized here. The BA/BE contain the list of species considered, local

population information, survey results, and suitable habitat descriptions on which effects of proposed projects are evaluated. Known or suspected species occurrence is based on historic records, current sightings, field review, and formal surveys. Presence of suitable habitat is based on the Six Rivers National Forest Vegetation Layer, 1998 aerial photographs, and field reviews conducted by fish and wildlife biologists and botanists.

Within the project area, there are eight historically active NSO home ranges. There is also one historical, but currently inactive peregrine falcon territory; one historical, but currently inactive northern goshawk territory; and one currently active bald eagle territory. The project area is roughly 29 air miles from the ocean and lies within marbled murrelet Zones 1 and 2 (US Forest Service and BLM 1994) while the closest known detection is 13 miles west.

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Under the no action alternative, no timber harvesting, temporary road construction, activity fuel treatments, or thinning activities would be implemented to accomplish project goals. No action would not cause change in any of the current conditions. The no action alternative would not promote conditions to meet habitat capability models or attainment of ACS objectives within these subwatersheds. This alternative would not remove or degrade any suitable habitat for any TES, MIS, NTM or S&M species; however the no action alternative would not accelerate the development of late-successional habitat nor protect existing late-successional habitat from stand-replacing fires.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Northern Spotted Owl (*Strix occidentalis caurina*), Threatened

Suitable NSO habitat is composed of multi-storied mature and old growth stands having multi-layered conditions, a canopy closure of 60 percent or greater, and obvious decadence (large, live coniferous trees with deformities such as cavities, broken tops, and dwarf-mistletoe infections). Overstory should be comprised of trees 21 inches or greater DBH and should comprise at least 40 percent of the total canopy closure. The Six Rivers National Forest definition of suitable habitat also includes stands with overstory canopy closure of less than 40 percent when these stands have a hardwood understory which increases the total canopy closure to 60 percent or greater.

Eight historic NSO activity centers are located within 1.3 miles of the proposed units. Surveys are being completed in the project area to determine if the activity centers are still occupied or if new activity centers have been established.

No suitable habitat would be removed during this project; however, fuels treatments and thinning may degrade 721 acres of currently suitable NSO habitat in the short term. Proposed treatments would not reduce the canopy closure within suitable habitat below 60 percent, large snags and downed logs would be retained, and no potential nest trees would be removed. Fuel treatments are designed to reduce ground and ladder fuels to limit the risk of fire disturbance on a

large scale, which can reduce the secondary canopy. Although multi-layered conditions contributing to suitable nesting habitat would be slightly reduced by felling understory trees and small snags, it would result in a greater assurance of long-term maintenance of late-successional habitat. In addition, within suitable habitat large logs (greater than 20 inches DBH and 10 feet long) and large snags (greater than 20 inches DBH) would be maintained until it became necessary to fell or remove them (i.e., during wildfire suppression).

Of the 1.7 miles of temporary roads to be constructed, approximately 0.4 mile (0.78 acres) are within suitable TES habitat. Of the 158 new or existing landings planned within the project, six (1.5 acres total) new landings are within suitable TES habitat. Road and landing construction or reconstruction would degrade suitable habitat but the habitat would remain suitable post project. The effects in any one area would be minimal and habitat would remain suitable after project completion. All temporary roads would be decommissioned after project implementation is complete.

Fuel treatments and understory thinning may be beneficial to the NSO in potential foraging habitat by opening thick sub-canopy vegetation, allowing increased access to prey. Canopy closure in all areas would be maintained at a minimum of 40 percent (60 percent in suitable habitat), which would maintain dispersal and foraging habitat for the NSO.

All burning is expected to reduce the quantity and quality of downed woody material to various degrees regardless of the season of burning. However, the wetter the conditions during the burn, the less the impact would be to the surrounding habitat components. Understory burning is designed to produce the least damage to the boles of the trees in the unit and to prevent fire from getting into the crowns of the overstory. Tree mortality would be minimal, mainly in the smaller size classes. Understory burning projects would be conducted when weather and fuel moisture conditions are appropriate to achieve a "cool" underburn. Fuel moistures and humidity are monitored to assure that the prescriptions are met. Burn prescriptions are designed to prevent severe burn levels, maintain a cover of fine organic matter on at least 50 percent of the burn area (US Forest Service Region 5 Soil Quality Standards and Guidelines), retain large down woody material, snags, and to result in light impacts to the canopy level of conifers and hardwoods. The objective is to keep flame lengths low, to minimize mortality of residual live trees.

Project implementation during the breeding season within 0.25 mile of an NSO activity center has the potential to create noise disturbance to nesting NSO. In order to minimize noise disturbance to known spotted owl pairs, no noise or smoke disturbance (heavy equipment use, chainsaw use, hauling, understory burning, and helicopter use) would occur during the spotted owl breeding season from February 1 through July 9 within 0.25 of an activity center. Although operations conducted between July 9 and July 31 are not expected to disturb nesting adults they have the potential to disturb newly fledged young. Limiting operating periods would be refine for each unit upon completion of 2008 survey results until then suitable habitat is assumed occupied.

In the long run, habitat conditions for the NSO would be improved in the project area by accelerating the development of late-successional characteristics in young stands and by

protecting existing habitat from stand-replacing fires. *The project is not likely to adversely affect the NSO*.

Northern Spotted Owl Critical Habitat - A total of 590 acres (5.9 percent) occur in a NSO Critical Habitat Unit (CHU #13). Primary constituent elements of CHU include forested stands that qualify as nesting, roosting, foraging, or dispersal habitat (trees greater then 11 inches DBH with greater than 40 percent canopy closure). Thinning may degrade 393 acres of nesting/roosting habitat , four acres of foraging habitat and 193 acres of dispersal habitat; however, the project would maintain 60 percent or greater canopy closure in nesting roosting habitat and a minimum of 40 percent canopy closure in foraging and dispersal habitat. Although multi-layered conditions contributing to suitable(nesting/roosting) habitat may be slightly reduced in the short-term by felling small snags and understory trees, it may result in a greater assurance of long-term maintenance of late-successional habitat in the CHU. The project would treat younger stands to accelerate the development of late-successional habitat, which would decrease fragmentation and increase patch-size of existing late-successional habitat. Fuel treatments in strategic areas would reduce the risk of fire ignitions along high use roads and provide greater protection to the CHU.

Fuel treatments and understory thinning may be beneficial to the NSO in potential foraging habitat in CHU by opening thick subcanopy vegetation, allowing increased access to prey. Canopy closure in all areas would be maintained at a minimum of 40 percent (60 percent in suitable habitat), which would maintain dispersal and foraging habitat for the NSO.

The risk of removing primary constituent elements through burning is low for burning based on the burn prescription, ignition methods, seasonality of the burns; however, there is a slightly greater increase of damaging trees, snags, and logs less than 11 inches in diameter associated with understory burning. Therefore, understory burns may degrade components of critical habitat within of the CHU, but the habitat would remain functional post-project. *The project may affect, but is not likely to adversely affect the NSO Critical Habitat*.

Marbled Murrelet (*Brachyramphus marmoratus*), Threatened

The project area straddles marbled murrelet Zone 1 and 2 (divided by the Klamath River). No marbled murrelet nest sites are known in the analysis area and the nearest historic detection is over 13 miles west. A total of 154, 155, 157, 207, 214 (129 acres) occur in potentially suitable marbled murrelet habitat. Surveys would be completed to ensure that no project activities occur in occupied marbled murrelet sites. If marbled murrelet are detected within a unit, the unit would be dropped or the prescription modified to ensure that suitable habitat components would not be removed or degraded.

Thinning would treat younger stands to accelerate the development of late-successional habitat, which would decrease fragmentation and increase patch-size of existing late-successional habitat. Fuel treatments would reduce the risk of fire ignitions along high use roads and provide greater protection to blocks of suitable marbled murrelet habitat. Although the project may remove small-diameter trees within suitable habitat, at least 60 percent canopy closure in

potentially suitable marbled murrelet habitat would be maintained in all areas. No predominant or potential nest trees would be removed. Although canopy closure in suitable habitat may be degraded, potential nesting habitat for marbled murrelet would not be removed.

Project implementation during the breeding season within 0.25 mile of suitable marbled murrelet habitat has the potential to disturb nesting marbled murrelet. If marbled murrelet are detected within the project area, no noise-generating or dense-smoke-generating (understory burning) activities would occur within 0.25 mile of the occupied marbled murrelet habitat, between March 24 and September 15.

Murrelet Critical Habitat -*Marbled murrelet critical habitat does not occur within the project area*. No activities would occur in occupied marbled murrelet habitat or in marbled murrelet critical habitat, and no project activities would occur within 0.25 mile of occupied habitat during the breeding season. *There would be no effect to the marbled murrelet or marbled murrelet critical habitat from project implementation*.

Sensitive Species

All Forest Service sensitive wildlife species known or thought to occur in the project area (based on habitat and range), were evaluated for this project. It was determined that the project will have no impact on certain Forest Service sensitive species, based on either the lack of habitat, lack of detections, or the fact that habitat will not be impacted. Species that would not be affected by this project include Townsend's big-eared bat (*Corynorthinus townsendii*), California wolverine (*Gulo gulo luteus*), American marten (*Martes Americana*), Western pond turtle *(Clemmys marmorata)*, and Northern red-legged frog (*Rana aurora aurora*). The following environmental consequences section focuses on those Forest Service sensitive species and/or habitat that may be affected by this project.

Bald Eagle (*Haliaeetus leucocephalus leucocephalus*)

Suitable nesting habitat is composed of low elevation, open (less than 40 percent canopy cover) mature/old-growth stands near permanent lakes and free-flowing rivers. In California, 87 percent of nest sites are within 1 mile (1.6 km) of water (Zeiner et al. 1990). Platform stick nests are built in large trees (greater than 36 inches DBH) with open branches, but some foliage usually shades the nest (Call 1978). Nests are located 50 to 200 feet (16 to 61 m) above ground, usually below tree crowns (Zeiner et al. 1990). Tree height and size appear to be more important than species.

Units 1, 2, 43 and 44 (125 acres) occur within the Wakaar bald eagle territory. The project would not remove known or potential nest trees (predominants), snags or reduce vegetative screening of the nest site within the primary disturbance zone of the Wakaar territory. Throughout the territory, snags over 28 inches, unless road hazard, would be maintained, unless they pose a safety hazard. No predominant tress would be removed, and canopy closure would be maintained at 40 percent or greater in younger stands and at least 60 percent in mid-mature and older stands. Although canopy closure in suitable habitat may be degraded, the project would not remove suitable nesting or foraging habitat for the bald eagle. The habitat would remain suitable post project.

No activities would occur within the primary disturbance zone or within line of sight of the nest during the breeding season (January 1 to August 31). *The project may impact individuals but would not cause a trend towards listing for the bald eagle.*

Peregrine Falcon (*Falco peregrinus anatum*)

The project occurs in the Five Mile peregrine falcon territory; however long-term monitoring has determined that the site is no longer occupied and that the nearest active nest is approximately 3 miles east of the project area.

The proposed actions would maintain the current capability of designated territory zones (LRMP). The project would not remove snags or reduce vegetative screening of the nest site within the primary disturbance zones of any territory. Within feeding zones, at least five hardwoods per acre would be maintained, and at least 75 percent of the area would remain in greater than pole size seral stage. The proposed actions would not result in habitat becoming unsuitable for prey species, nor would it degrade the quality of suitable habitat for foraging. *The project would have no effect on the peregrine falcon.*

Northern Goshawk (*Accipiter gentiles*)

Goshawks in northern California prefer mature and old-growth conifer forests that are at middle to high elevations, have relatively dense canopy closures, usually have little understory vegetation, are in close proximity to riparian corridors, and have flat or moderately sloping terrain (Crocker-Bedford and Chaney 1988; Moore and Henny 1983; Saunders 1982; Zeiner et al. 1990). Interspersed meadows or other openings are also required. Moderate and high quality habitats contain abundant large snags and logs that provide prey habitat and plucking perches (Hall 1984). Suitable habitat is used for nesting, foraging, and roosting.

There is suitable goshawk habitat in and within 0.25 mile of the proposed project area. The project is within 0.25 mile of one designated network core areas as defined in the LMP for goshawk although it is thought to be inactive. Surveys for goshawks were completed in 2002 and 2007 resulting in no detections. Protocol surveys will be completed in 2008.

Based on the Habitat Capability Model for this species, habitat quality is low to moderate (LRMP FEIS, Appendix B, Table B-18). Suitable habitat for the goshawk may be degraded by project implementation, but it will remain suitable following the project. In occupied units no predominant trees (potential nest trees) would be removed and at least 60 percent canopy closure would be maintained in suitable habitat. Removal of dense understory vegetation may improve foraging conditions for the goshawk.

No project activities would occur within a 200-acre area around any active nest from March 1 to August 31. *The project may impact individuals, but would not cause a trend towards listing*.

Pacific fisher (*Martes pennanti pacifica*)

Fishers occupy mid-elevation, multi-storied mature and old-growth mixed-conifer and deciduous-riparian habitats with moderate to dense canopy closure (greater than 50 percent), scattered patches with six to eight large snags per acre, and abundant down logs (Buck et al. 1983,

Schempf and White 1977). Fishers use cavities in large trees, snags, logs, rock areas, brush piles, and concentrations of downed woody debris for denning and nesting. They forage primarily in dead wood. Therefore, both standing and down log densities are important indicators of habitat quality. Fishers use ridges and streams, covered by closed canopy forests, when moving between quality habitat areas (Buck, personal communication).

No project-specific surveys have been completed for the fisher, although surveys have been conducted in the affected watersheds. Fisher are known to occur in the project area; however no den sites have been located.

Timber harvest and temporary road construction may affect suitable habitat. Thinning would occur in 721 acres of suitable fisher habitat. Affects to suitable habitat by the proposed thinning activity would be minimal due to a post-project canopy closure of at least 60 percent, retention of large trees with deformities, and retention of all predominant and most dominant trees.

All burning is expected to reduce the quantity and quality of downed woody material to various degrees regardless of the season of burning. However, the wetter the conditions during the burn, the less the impact would be to the surrounding habitat components. Understory burning is designed to produce the least damage to the boles of the trees in the unit and to prevent fire from getting into the crowns of the overstory. Tree mortality would be minimal, mainly in the smaller size classes. Understory burning projects would be conducted when weather and fuel moisture conditions are appropriate to achieve a "cool" underburn. Fuel moistures and humidity are monitored to assure that the prescriptions are met. Burn prescriptions are designed to prevent severe burn levels, maintain a cover of fine organic matter on at least 50 percent of the burn area (US Forest Service Region 5 Soil Quality Standards and Guidelines), retain large down woody material, snags, and to result in light impacts to the canopy level of conifers and hardwoods. The objective is to keep flame lengths low, to minimize mortality of residual live trees.

If a den site should be discovered, no project activities would occur within 0.25 mile around the site from February 1 to May 31. The Pacific fisher is a federal candidate species (as well as a Forest Service Sensitive Species), currently being considered for listing under the ESA. Implementation of this project *may impact individual fisher, but would not appreciatively diminish the recovery options* for this species on the Six Rivers National Forest.

Yellow-legged frog (*Rana bolyii*), Southern torrent salamander (*Rhyacotriton variegates*)

A total of 406 acres of treatment would occur in riparian reserves. Only hand treatment would occur in older stands.

No heavy equipment would be used within riparian reserves and only low-intensity fire would be allowed through the riparian reserves. Directional falling would be used within riparian reserves to further protect stream banks. Thinning young stands within riparian reserves would improve habitat conditions and would meet ACS objectives. Suitable habitat for these species may be degraded by project implementation, but it would remain suitable following project completion. *The project may impact individuals, but would not cause a trend towards listing*.

Cumulative Effects

The OCFR planning area is 9,840 acres and lies within the upper headwaters of small tributaries draining into the mainstem of the Lower-Middle Klamath River. The Lower-Middle Klamath watershed is broken out into three separate 7th-field subwatersheds for the OCFR project area. They are Ikes-Wilson to the north, Cheenitch and Boise Creek to the south. Based on species-specific territory size (e.g., bald eagle or northern spotted owl), and the potential for foraging, dispersal, and migration beyond the planning area watersheds; the cumulative effects analysis area for wildlife addresses impacts in these watersheds and three others; Natuket-Klamath River, Browns Creek, and Pearch Creek. These six watersheds define the cumulative effects analysis area for wildlife and total 44,229 acres. The time-frame for analysis ranges from approximately the past 30 years and projected 10 years where data is relevant and available for interpretation.

Past management activities in these watersheds have included timber harvest and moderate mining. The negative impacts from past timber harvest have included habitat removal, degradation, and fragmentation, which affected not only nesting habitat, but also important foraging and dispersal habitat. Approximately 1,904 acres have been harvested (approximately 4.3 percent) of the analysis area.

Past management actions such as timber harvest, road building and fire suppression have altered the natural disturbance regimes. In the LMK Watershed Analysis it is stated that the main factors that have affected most of the wildlife species of concern stem from two main ecosystem processes or management practice are: (1) changes to the historic fire regime, and (2) stand-regeneration logging of older forest stands. Currently, there are 721 acres (7.3 percent) of suitable habitat for late-successional habitat species such as the northern spotted owl (NSO) in the project area.

Past management actions such as timber harvest, road building and fire suppression have altered the natural disturbance regimes. In the LMK Watershed Analysis it is stated that the main factors that have affected most of the wildlife species of concern stem from two main ecosystem processes or management practice are: (1) changes to the historic fire regime, and (2) stand-regeneration logging of older forest stands. There are 721 acres (7.3 percent) of suitable habitat for late-successional habitat species such as the northern spotted owl (NSO) in the project area. There are approximately 19,969 acres (45 percent) of potentially suitable habitat for late successional habitat species in the analysis area. This project will not remove suitable habitat available to these species in the watersheds.

Thinning treatments proposed throughout the project are expected to provide long-term benefits through the accelerated development of late-successional habitat. Thinning in younger stands throughout the project area would reduce inter tree competition, which would accelerate the growth and development of the remaining trees. Late-successional characteristics would be achieved in less amount of time than if the treatment were not done. Accelerating the development of late-successional characteristics would move the area toward the historic range of variability of seral stages, reduce fragmentation of habitat, and increase patch size. Thinning prescriptions and fuel reduction would degrade 721 acres (1.6 percent occurs within the analysis

area) in the planning area of suitable habitat, depending on species-specific requirements, in the short-term but it would remain suitable following project completion and is expected to improve habitat conditions in the long term (accelerate the development of late-successional characteristics). In the long term, the project would benefit TES, MIS, and other wildlife species.

In addition to these terrestrial effects, improvements in riparian reserve connectivity and microclimate conditions would occur as late-successional characteristics develop along riparian/terrestrial interfaces in natural and plantation stands. Therefore, the overall net effects of these terrestrial actions would eventually lead to improvements in ecological functions across the riparian and stream network of the proposed project area, including woody debris recruitment and multi-story canopy functions.

Other Required Disclosures for Wildlife Resources

Management Indicator Species (MIS)

Under the National Forest Management Act (NFMA), the Forest Service is directed to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." (P.L. 94-588, Sec 6 (g) (3) (B)). The 1982 regulations implementing NFMA require that "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area." (36 CFR 219.19) Management Indicator Species (MIS) is a concept used by the agency to serve as a barometer for species viability at the Forest level. Population changes of MIS are believed to indicate the effects of management activities.

Under the LRMP, MIS species are used to assess potential effects of project activities on the various habitats and habitat assemblages with which these species are associated. The primary vegetation subseries in the project area are: Douglas-fir/tanoak, Douglas-fir/canyon live oak, Douglas-fir/incense cedar, Douglas-fir/big leaf maple, tanoak/canyon live oak, Jeffrey pine/California fescue, tanoak/black oak, and tanoak/dry shrub. Canyon live oak as a codominant species in many stands of the project area is an indicator of relatively dry conditions with high surface rock content. Less common were stands with such species as big-leaf maple indicating mesic condition and Jeffrey pine indicating serpentine soils.

The potential impacts to MIS were analyzed and the results are summarized here. The full report is located in the project file. The project would not adversely impact MIS. Potential impacts to MIS species would be minimized through the adherence of LRMP standards and guidelines for snags/down woody debris, riparian reserve buffers, and maintenance of canopy closure. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Canopy closure would be maintained at 60 percent or greater in late-successional habitats, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80 to 100 percent of the average numbers found within mature and old

growth stands within the Forest. Any snag felled for safety reasons would be left on site as downed woody debris.

This project would remove a total of 66 acres of early seral stage habitat due to landing and road construction for species that use early seral stages as well as late successional stands (such as the black bear, Hammond's flycatcher, hairy woodpecker, and others), which represents 0.6 percent of the suitable habitat available to these species in the watershed analysis area. The thinning and fuel treatments occur within 721acres are considered suitable for late successional associated species. Thinning and fuel treatments would degrade approximately 1.5 percent of the suitable habitat for these species available in the watershed. Approximately 3 percent of suitable habitat for early seral stage species would be degraded in the watershed.

Reduction in canopy density may result in small local changes in microclimate in the short term prior to remaining tree crown improvement. Removal of a portion of the conifer stand may result in the establishment of hardwoods and a multi-story canopy in the monotypic conifer stands, improving the canopy density and shade for MIS. These indirect effects would lead to improved habitat function.

There is some potential for short-term ground disturbance within habitat areas from the cutting, felling, and yarding of trees and fuel treatments. Short-term negative impacts could occur from the implementation of pile and understory burning. Understory burning may also cause short-term habitat degradation through the loss of small woody debris; however, burning would occur under specific weather and moisture condition designed to minimize damage to the residual stand, maintain large woody debris, and maintain at least 50 percent of the duff layer. Some minor local increases in fuels may occur from project-generated slash, but due to proposed post-harvest fuel treatments, fuel loading would not be a threat to the treated areas. In the long term, reduction of fuel ladders would improve stand resilience to fire disturbance.

Neotropical Migrants (NTM)

The potential impacts to neotropical migrant species were analyzed and the results are summarized here. The full report is located in the project file. The project would not adversely impact migratory species or their associated habitats. Potential impacts to migratory species would be minimized through the adherence of LRMP standards and guidelines for snags/down woody debris, riparian reserve buffers, and maintenance of canopy closure. The majority of the project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Canopy closure would be maintained at 60 percent or greater, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80 to 100 percent of the average numbers found within mature and old growth stands within the Forest.

Conclusion: Other Required Disclosures for Wildlife

- **No Action:** This alternative would not remove or degrade any suitable habitat for any TES, MIS, NTM or S&M species; however the no action alternative would not accelerate the development of late-successional habitat nor protect exiting late-successional habitat from stand replacing fires.
- **Proposed Action alternatives**: In critical habitat units and riparian reserves, and suitable TES habitat, the combined effect of the proposed actions (thinning, work in plantations, and establishing fuelbreaks and other fuel treatments) would result in a lower fire risk and hazard in the short-term, and an acceleration in the development of late-successional characteristics in current mid-mature stands in the long term.
- In addition to these terrestrial effects, improvements in riparian reserve connectivity and microclimate conditions would occur as late-successional characteristics develop along riparian/terrestrial interfaces in natural and plantation stands.

Environmental Concerns Regarding Sensitive Fungi and Plant Species and Matsutake Fungi

Affected Environment

Sensitive Plants and Potential Sensitive Fungi Occurrences

The pre-field analysis included review of the Forest sensitive database and associated spatial layers of known occurrences relative to the project area, assessment of the vegetative sub-series and stand age in which the project occurs and the potential of the project area to support sensitive species, elevation gradient of the project area, land-use history, and professional knowledge of sensitive species habitat and distribution on the Forest.

Based upon the pre-field analysis, approximately 1,356 of the 2,698 unit acres (51 percent) were surveyed for vascular and non-vascular sensitive species based upon pre-field analysis for potentially suitable habitat. Units or portions thereof not subject to survey were plantations and those characterized by shrub-dominated communities, or vegetation sub-series or seral stages lacking habitat components for sensitive species, such as canyon live oak-dominated units indicating dry, rocky conditions. The list of unit and survey status is included in the administrative file.

Surveys of units with potential habitat occurred from May 5 to August 9, 2006. The earliest surveys focused on potential habitat for Howell's montia, which emerges earlier and for a shorter period than any of the other vascular plant species. If present, all of the other vascular and non-vascular species could have been detected between May and August. Surveys were not conducted for any sensitive fungi species. The reasons for not undertaking surveys include the biology of fungal organisms. The fungal body occurs underground as a mass of threadlike structures (hyphae) called mycelia. The fungal body or mycelia does not produce reliable fruit year to year; therefore, surveys are infeasible. Another reason is the nature of the project which is designed to retain habitat components for fungi. The rationale for this decision is further explained under "Environmental Effects" below.

Surveys resulted in the finding of four sensitive species in various units (Table 26) and potential habitat for sensitive fungi exists in the mature stands surveyed. No other sensitive

vascular or non-vascular species were located. Sensitive species accounts are included in Appendix A of the Biological Evaluation/Biological Assessment for Threatened, Endangered, Sensitive Plant and Fungi Species for the OCFR Project (Hoover 2008).

Table 26. Sensitive plant occurrences in the OCFR project area[1]

Species	Taxonomic Group	Number of Occurrences	Units
Buxbaumia viridis	Bryophyte	1	114
Ptilidium californicum	Bryophyte	14	142,146,147,149,150,152,154,157,171, 203,223,224
Sulcaria badia	Lichen	1	22
Thermopsis robusta	Vascular Plant	8	101,142,146, 147,149,161,166 (note: most occurrences were on roads aligning the units or landings next to a unit)

1 Units 142, 146 contained two occurrences for Ptilidium and Unit 149 contained two occurrences for Thermopsis.

Matsutake Fungi

American matsutake (*Tricholoma magnivelare*) is an ectomycorrhizal fungus. Ectomycorrhizal fungi form a mutual relationship with a host whereby the host (e.g., tanoak) provides carbohydrates to the fungus and the fungus, through its underground networks (hyphae), scavenges the soil for nitrogen, phosphorus and water for the host. These hyphae can grow to infect nearby plant roots and can eventually connect neighboring plants.

Matsutake is not host-specific but can develop an ectomycorrhizal relationship with various trees species. It tends to favor stands that are composed of various conifer and hardwood species, structurally arranged in a multi-layered canopy. Matsutake is typically not found in stands less than 50 years of age, but may fruit "more abundantly in young to middle-aged stands that develop after disturbance (e.g., logging or fire) than in undisturbed stands…" (Hosford et al. 1997). Forest floor organics including litter, humus and coarse woody debris are important micro-habitat features for the fungi. Organics provide shade and can house mycelia; partially decayed logs serve as reservoirs of water for hyphae. As an ectomycorrhizal fungus, matsutake is benefited by duff or twig layer up to 6 inches but deeper organic substrate may promote other ectomycorrhizal fungi, thus potentially out-competing the matsutake (Hosford et al. 1997).

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Under no action, the existing conditions pertaining to stand structure and fuels would remain barring uncontained wildfires and other small-scale disturbances pertaining to landslides, windthrow and individual tree mortality. Sensitive plant species such as *Ptilidium californicum* and *Buxbaumia viridis* that occupy mature trees or advanced decay logs, are dispersal limited and appear to prefer stable conditions may be favored by the no action alternative.

Early seral species such as *Thermopsis robusta*, which appear to require disturbance to germinate and grow, would remain stable in the short-term where it currently occurs. A sustained

period without disturbance (natural or human-caused) may lead to local extirpations in the long-term and little opportunity for expansion of occurrences.

Some fungi like matsutake may not tolerate accumulations of litter and humus on the forest floor. In a fire suppression environment, understory burning provides the next best option to reducing thick accumulations of forest floor organics. No understory burning would occur under the no action alternative. Micro-scale disturbance thresholds, those operating on the forest floor, for other fungi like the sensitive ectomycorrhizal and saprobic fungi are little known. It is assumed that some may benefit by accumulation of litter, humus and coarse woody debris that would occur under the no action alternative and others may be inhibited.

Alternative 2 - Proposed Action

Direct and Indirect Effects

Sensitive Plants

Ptilidium californicum (PTCA) *and Buxbaumia viridis* (BUVI)

PTCA and BUVI were both detected in association with a specific substrate; mature Douglas-fir trees and a decayed stump, respectively. Direct and indirect effects are those that remove the substrate, alter micro-climatic conditions around the occupied substrate or in the case of PTCA, isolate the site (Harpel and Hoover 2006a, 2006b). Project design features (Appendix C) incorporating a 25-foot radius no-disturbance buffer (except for removing dead fuels) around the occupied substrate would alleviate any direct effects to either species. A 50-foot radius buffer that maintains 60 percent canopy cover around PTCA would alleviate indirect effects to the occupied substrate, maintain immediate micro-climatic conditions and reduce the effect of potential changes in surrounding micro-climatic conditions (e.g., slight increases in wind speed and subsequent drying effects). Stand-level prescriptions that maintain 60 percent canopy cover and provide scattered trees that could serve as dispersal sites for PTCA also reduce any indirect impacts resulting from project implementation. *Buxbaumia viridis* would be protected from indirect impact by its proximity to a riparian reserve and such stand-level features as snag and log retention and maintenance of 60 percent canopy cover.

Sulcaria badia

Sulcaria badia was found as litterfall in Unit 20. Substrate was assumed to be the closest mature tree to the litterfall and was thus flagged. Existing overstory and subcanopy trees would be retained surrounding the site therefore, retaining immediate micro-climatic conditions. Lichens are metabolically active when hydrated and thus vulnerable to heat and other stresses. To alleviate concerns for heat stress in the event pile burning and understory burning occur when the lichen is hydrated, a no-disturbance buffer of 25-foot radius has been established around the flagged tree in unit 20 suspected of supporting *Sulcaria badia*.

Retention of overstory and subcanopy trees and the no disturbance buffer would alleviate concerns for any direct or indirect effects to *Sulcaria badia*.

*Thermopsis robusta (*THRO*)*

THRO is an early seral stage species. Its occurrence in each of the units notated in Table 26 is associated with disturbed settings (e.g., adjacent to Unit 101 on road 13N18B, on an old skid trail in previously logged Unit 146, and on landing and old skid trail associated with Unit 142). Occurrences have been flagged in the field.

Direct impacts are those that physically remove or intensely damage the plant and include road and landing construction/reconstruction, skidding, hand treatments and pile burning activities. Project design features for sensitive species (Appendix C) include provisions to avoid direct impacts to THRO occurrences with the exception of plants occurring on the landing associated with Unit 142. This occurrence consists of 17 adult plants. Landing construction would directly impact 50 percent of the occurrence. Plants on the edge of the landing would be protected against direct impacts, thereby, leaving plants to provide a propagule source for potential establishment on the adjacent disturbed soil.

Indirect effects of ground disturbance or pile burning adjacent to THRO are considered beneficial to this species. Disturbance near an occurrence can create suitable habitat for THRO seed dispersal and establishment.

Potential Sensitive Fungi Occurrences

Boletus pulcherrimus, Dendrocollybia racemosa, Phaeocollybia olivacea, and Sowerbyella rhenana

Surveys were not conducted for sensitive fungi due to their ephemeral habit and the expected retention of habitat components important to most fungi across the units. Effects are discussed in light of the magnitude of changes in the habitat as a result of project implementation and by activities that may affect ECM and saprobic fungi include new disturbance related to overstory thinning, shrub and small tree cutting for fuels treatment, pile burning, yarding, understory burning, removal of forest floor organics, and new landing, skid trail, and temporary road development. Of the activities proposed, ground-based logging systems with skid trails, skyline corridors, and development of new temporary roads and landings associated with all of the logging systems are activities that would remove forest floor organics and thus important habitat components for sensitive fungi.

Twenty-nine percent or 789 acres are proposed for thinning with ground-based equipment. New temporary road construction would affect 1 acre, of which most of that would correspond with mature stands. The creation of new landings over 0.5 acres, 5 of which are an estimated 2 acres in size, would completely remove 12 acres of potential habitat over 11 sites, thereby retaining no habitat components for Sensitive fungi.

Direct and indirect negative effects of these activities pertain to removal or severance of mycelial components (which comprise the fungal organism) residing in the organic or topsoil layer for ECM, reduction in canopy shade and organic forest floor cover, reduction in the abundance of host trees and refuge species to sustain inoculum through periods of successional change in the stand, removal or reduction of forest floor organics and coarse woody debris which

form the primary micro-habitat for saprobic species, and breakdown of soil structure (e.g., compaction) which not only affects the mycelia therein but also damages fine root tips to which the mycelia attach (Amaranthus et al. 1996).

To reduce the potential and magnitude of negative direct and indirect effects associated with implementing OCFR activities, the following stand attributes should be retained at some level:

- diversity of host trees
- layered canopy structure
- scattered individuals or patches of shrubs in the understory
- patches of forest floor organics and coarse woody debris

Clearings for landings over 0.5 acre would not maintain any habitat components for sensitive fungi. If present, sensitive fungi would likely be extirpated from areas directly impacted by construction of new landings. Beyond the impact at new landing sites, project design features (Appendix C-FEIS) have been developed for all other activities that may direct or indirectly affect sensitive fungi. These project design features would retain attributes of a stand that would in turn reduce or eliminate the potential for direct or indirect effects to sensitive fungi species in the units:

- Under Silviculture - previously unmanaged stands (item #1) and regeneration stands older than 30 years (item #3), would maintain habitat components necessary for sensitive fungi by providing host trees, canopy cover, (thus shade to the forest floor), and retention of tanoaks in regeneration stands.
- Under Fuels - low-to-moderate burn prescriptions (#2) and retention of scattered trees and shrubs (#3, #4) would provide for (a) remnant woody debris, (b) needle/leaf litter or humus layer on the forest floor; (c) understory host species for mycorrhizal connections; and (d) micro-habitat for mycelia of various fungi.
- Under Soil and Water - limiting skid trails to 15 percent of the unit (item #9), retaining 90 percent soil porosity over 85 percent of the unit area (#10), and retaining 50 percent of the litter and duff layer over the unit area (#11), would reduce the extent of mycelial damage, damage to the soil structure and the displacement of forest floor organics.

While not eliminating effects to fungi, it is assumed by managing for habitat elements in thinning and hand treatment units, adverse effects on ECM and saprobic communities can be reduced. Effects of relatively small scale activities are not likely to significantly reduce the fungal species diversity that was in place prior to the disturbance (Durall et al. 1999, Hagerman et al. 1999). In certain areas in a stand, micro-habitat features would be impacted by skidding, felling of canopy trees, yarding tops, endlining or pile burning, but mycelial networks can extend several meters through the forest floor, so conceivably localized impacts may impact or sever part of the fungal individual but would not necessarily impact the entire body of the organism. Furthermore, if vegetative and soil conditions are retained in places within the unit, spores stored in the soil provide a propagule for development of fungi after the disturbance. These impacted areas would

recover in time and along with it the development of fungal communities (Dahlberg and Stenlid 1995).

It is recognized that there are variables other than presence of host species, shade, and litter/duff material that influence fungal community structure and diversity (i.e. moisture condition, disturbance regime, inter- and intra-specific competition, regional soil differences, resource partitioning, other mycorrhizal associations) but it is assumed that the vegetative condition and nature of forest floor organics would serve as a surrogate for these more specific variables.

Matsutake Fungi

Activities identified that may affect Sensitive fungi pertain to matsutake fungi as well. Likewise, as an ectomycorrhizal fungus, the potential direct and indirect effects to matsutake fungi are akin to the effects on Sensitive fungi described above. A distinction is the availability of information on matsutake's apparent threshold to litter and duff accumulation. As an ectomycorrhizal fungus, matsutake fungi are benefited by duff or twig layer but only up to approximately six inches. Deeper organic substrate may promote other ectomycorrhizal fungi, thus potentially out-competing the matsutake fungus (Hosford et. al. 1997). Potential beneficial effects pertain to proposed low-to-moderate intensity understory burning which may reduce the depth of forest floor organics which in turn might favor matsutake fungi which prefer litter/duff depths less than six inches.

Hand treatments with handpiling and burning would result in the least amount of impact to matsutake fungi and its habitat components since overstory cover, host trees, and scattered forest floor organics would be retained. Endlining and yarding tops adds localized ground disturbance potentially down to mineral soil, with the latter potentially removing unintended vegetation during the course of yarding tops with branches. Ground based equipment requires the development of skid trails upon which the equipment operates, which requires complete removal of vegetation along a corridor.

Units specifically mentioned for supporting matsutake fungi are: Units 20, 28, 142 and 173. Across the units (Table 27), treatments in Unit 142 have the greatest potential of locally affecting matsutake fungi compared to treatments in the other units.

To reduce the potential or magnitude of negative direct and indirect effects associated with implementing OCFR activities, the following stand attributes should be retained at some level: (1) diversity of host trees; (2) canopy structure; (3) scattered individuals or patches of shrubs in the understory; and (4) patches of forest floor organics and coarse woody debris. Specific design features are listed in Appendix C. While not eliminating effects to matsutake fungi, it is assumed by managing for habitat elements, adverse effects matsutake fungi can be reduced. Potential consequences of small-scale activities such as pile burning and endlining are described under Sensitive fungi.

Table 27. Units identified as supporting matsutake fungi and the associated treatments

Units with Known Occurrences of Matsutake	Unit Acres	Treatments: Vegetation/Fuels HP= hand pile, cutting brush, piling & burning YT= yard tops, pulling top of tree and piling	Effect Risk Rating[1]
20	14.9	Endline & Hand Treatment/HP & Burn	2
28	28.4	Hand Treatment/HP & Burn	1
142	43.9	Ground based (41.7) & Hand Treatment (2.2)/ YT/HP & Burn	4
173	10	Hand Treatment/YT/HP & Burn	3

1Criteria for rating: extent of vegetation removed in the unit, intensity of ground disturbance in the unit; 1 being the least damaging, 4 being the most damaging

Cumulative Effects

For this project, the spatial context for cumulative effects analysis is at the local scale since this is the appropriate scale of a population (plant and fungal). A population is the fundamental biological unit for a species. It is at this unit that effects are most readily detected. While consideration is given to the status of a species across its range and the planning unit (i.e. Forest) when assessing cumulative effects, detailed analysis of effects for rare taxa beyond the local scale is not often biologically meaningful due to variables associated with particular activities and varying (and often unknown) thresholds of a species to disturbance. In the case of this project, the local scale spatially incorporates past, present and foreseeable activities or events on public and private land that are within or adjacent to the project area boundary. This area is within the 7th field watershed encompassing approximately 44,000 acres.

In keeping with the spatial scale, the temporal context for assessing past activities would coincide with the timing of those activities. Information about timber projects on public land date back to 1978 (Appendix D - Table D-1). The fire history record coinciding with portions of the project area date as far back as 1910. The most recent wildfire overlapping the proposed action units is the Wilder Fire which burned 33 acres of which only two acres were stand replacing. Details on earlier fires are not available.

The only foreseeable future activities are those associated with implementing the proposed action alternative, Orleans Community Protection Project (CPP) and the Orleans Transportation and Road Restoration Project. For private land, information on past timber projects are only available as far back as 2001 (Appendix D - Table D-2). Other than scheduled timber harvest, detailed information on residential or other developments on private land is not available. Time frame for foreseeable future actions on both public and private land is estimated 10 years out coincident with the span of time to implement the proposed action alternative, Orleans CPP and private timber harvest plans.

The species and taxonomic group addressed in this section are those for which there may be direct or indirect effects; specifically, *Ptilidium californicum*, *Thermopsis robusta*, and potential Sensitive fungi. Matsutake fungi are not Forest Sensitive species, however; the cumulative

effects analysis conducted for Sensitive fungi would apply for the most part to matsutake fungi as well. There are no cumulative effects associated with *Buxbaumia viridis* or *Sulcaria badia.*

Sensitive Plants

Ptilidium californicum (PTCA)

PTCA occurs from Alaska south to an occurrence on Mendocino National Forest. The species is considered relatively widespread and abundant in the Pacific Northwest but in California, it occurs as scattered concentrations in the Klamath Mountains and as disjunct occurrences in the southern portion of its range on the Mendocino National Forest (Harpel and Hoover 2006b).

Including survey results for this project, there are 68 documented occurrences of PTCA on Six Rivers with a majority of those occurrences associated with the Klamath Mountains on the Orleans Ranger District. All the occurrences are in the central or northern portions of the project and above 2,400 feet. The nearest "cluster" of PTCA outside the project area occurs an estimated 10 miles north in the headwaters of the Blue Creek watershed.

Discussion of past, present and foreseeable future actions would focus on those that clearly alter habitat conditions for PTCA (e.g., clearcuts, intense wildfire). Of the proposed action units in the project area, 1,010 acres (or roughly half of the 2,698 unit acreage) are currently in the pole or shrub/forb seral stage and 351 acres are early mature. These acres were subject to either clearcuts, patch cuts, shelterwood or seed tree prescriptions which leave little to no overstory or the by product of high intensity wildfire. Most of the relatively high intensity logging occurred between 1978 and 1988 before PTCA was a sensitive species (Appendix D- Table D-1 and D-2). Approximately two-thirds or approximately 820 of the acres affected by past activities that retained little to no canopy cover correspond with the range of PTCA in the project area. It is assumed that a proportion of the mid-late mature trees removed supported PTCA and the clearings fragmented the habitat for this species.

Due to the variables associated with past thinning and selection prescriptions, it is difficult to determine their effects on PTCA, if any; therefore, these activities will not be further discussed. An exception pertains to relatively recent thinning of the Donahue Project. PTCA was located in two former Donahue units. The Biological Evaluation for those projects assigned protective measures for the occupied tree; however, thinning intensity around the two occurrences in Unit 142 and one of the occurrences in Unit 146 has opened the canopy below 40 percent. The reduction in canopy has increased the potential for edge effects pertaining to solar radiation and wind such as increased drying or increased heat. By its occurrence in mature (mid-late) stands and its location on the tree at the very base and often on the north-facing bole, it is assumed PTCA prefers some buffer against drying or heating agents.

Where canopy cover is less than 60 percent, maintaining existing canopy cover within a 50-foot radius of an occupied tree was designed (Appendix C) to alleviate further breakdown of the habitat conditions; however, past thinning in Units 142 and 146 has left a depauperate canopy cover around the occupied trees and thus a limited basis to work with. This altered stand-level

habitat condition for PTCA may ultimately stress the individuals at these sites and weaken the health of the thallus.

Aside from implementing various aspects of OCFR, there are no foreseeable future activities planned for the project area with the exception of continued implementation of the Orleans CPP and the implementation of road decommissioning associated with the Orleans Transportation and Road Restoration Project. The latter project would operate on previously disturbed ground so would not affect PTCA. Given the nature of activities associated with the Orleans CPP project and the project's design features to reduce effects to any PTCA occurrences in this project's area, implementation of Orleans CPP is not expected to contribute cumulative effects to PTCA.

Wildfire is a natural disturbance agent in the forest types where PTCA occurs. Historic and past fire patterns may influence PTCAs within-stand distribution whereby, thalli persist in refugia micro-sites not subject to intense fire. PTCA was not documented in the units subjected to a past fire documented between 1950 and 1959; however, this does not assign cause to the wildfire. Past wildfire has contributed cumulatively to the distribution of PTCA within stands and across the landscape but this effect is considered an ecological process that has influenced the distribution of refugia sites across the landscape.

Private lands whether planned for timber harvest or residential development constitute roughly 3,790 acres (12 percent) of the 30,585 watershed that encompasses the project area. Past or foreseeable future timber harvest activities on private land are weighted in the southern portion of the project area. The southern portion is under 1,600 foot elevation which is below the elevation range for PTCA; therefore, logging activities on private land have not or are not expected to contribute to the cumulative effects for this species. Past and foreseeable future residential or agricultural developments on those private acres within the range of PTCA (central and northern portion) are unknown.

In summary, past activities associated with clearcuts, patch cuts, shelterwood or seed tree cuts have contributed cumulative effects to PTCA by removing or substantially altering habitat conditions for PTCA. Thinning in Donahue Units 142 and 146 may lead to the loss of PTCA individuals associated with these units. While past activities have contributed cumulative negative effects to PTCA, these effects would not constitute a trend toward federal listing or loss of viability due to a) the expected persistence over time of 11 occurrences (15 occupied trees) of PTCA distributed across the northern and central portion of the project area, b) the probable existence of PTCA in the suitable habitat between the project area and the Blue Creek Watershed where PTCA is documented, thus providing connectivity between the two areas, c) the Klamath Mountains being the geographic center of PTCA in California and, d) the distribution of PTCA in the Pacific Northwest where it is not considered a rare species.

Thermopsis robusta (THRO)

Thermopsis robusta is endemic to Humboldt and Siskiyou Counties, specifically the Orleans and Ukonom Ranger Districts on the Six Rivers National Forest and the Happy Camp Ranger District on the Klamath National Forest. Response of THRO to past activities or events would be

opposite that of PTCA in that the habitat for THRO is early seral. Where THRO is found, it is associated with roadside settings, landings, skid trails and high intensity burned areas. The threshold for this species has not been determined but based upon where it is observed, it appears to respond positively to sites of intense disturbance. Past activities and foreseeable future activities that involve some level of ground disturbance would provide sites for potential establishment, thus benefiting the species. The limiting factor is likely the proximity of adult plants to the sites of disturbance. Cumulative effects of past, present and foreseeable actions on THRO have likely been positive in nature.

Potential Sensitive Fungi Occurrences

Boletus pulcherrimus, Dendrocollybia racemosa, Phaeocollybia olivacea, and Sowerbyella rhenana

The North American range of the sensitive fungi addressed in this project extends from Washington to central California. There are 12 documented occurrences of *Boletus pulcherrimus* in the state, 32 *Dendrocollybia racemosa*, 40 *Phaeocollybia olivacea* and 20 *Sowerbyella rhenana*. Surveys were not conducted for Sensitive fungi in the project area; however, mature conifer-hardwood stands in the project area constitute potentially suitable habitat.

Similar to PTCA, the past activities and events that would contribute cumulative impacts to PTCA are those that would compromise or remove occupied trees, overstory canopy cover, understory shade around the occupied tree and forest floor organics. In addition to the past clearcuts, shelterwoods, patch cuts and seed tree prescriptions (Appendix D) that have impacted roughly 1300 acres, landings developed in association with all of these projects as well as past and foreseeable future shelterwood and fire salvage prescriptions (approximately 102 acres) on private lands nested within the project area have degraded or would degrade or eliminate habitat for Sensitive fungi. Aside from landings developed for logging, past thinnings, low intensity wildfire, and activities associated with fuels management (e.g., pile burning, broadcast burning) whether on public or private land are not expected to contribute negative cumulative effects to Sensitive fungi. Broadcast burning and low intensity wildfire may actually benefit Sensitive fungi by diversifying the structure of the forest floor organics.

The fire history record includes wildfires in the project area dating back to 1910 and up to 2005. Areas subjected to high intensity wildfire (e.g., approximately 2 acres associated with the 2005 Wilder Fire) have lost habitat components for Sensitive fungi in the short-term. As the fire area recovers, spores of the fungus may move into the burn area and mycelia may develop underground in association with the roots of trees that become established. All past and future wildfires have influenced the distribution and abundance of sensitive fungi but the direction of this influence, negatively or positively, cannot be determined due to the many variables associated with fires and the individualistic response of a species to a changed environment.

Aside from the proposed action alternative, there are no foreseeable future activities on public land planned for the project area with the exception of continued implementation of the Orleans CPP and the implementation of road decommissioning associated with the Orleans Transportation

and Road Restoration Project. The nature of activities associated with these projects and the project design features in place for Orleans CPP are expected to maintain habitat components for fungi and therefore, not expected to contribute cumulative effects to any sensitive fungi species.

On private land, a shelterwood removal project is planned for 100 acres in the southern portion of the project area. Assuming the stand affected is within the mature seral stages, this foreseeable future activity would remove habitat components for sensitive fungi. Foreseeable future residential or agricultural activities on those private acres not slated for timber harvest are unknown.

In summary, past activities associated with clearcuts, patch cuts, shelterwood or seed tree cut (estimated 1,300 acres), landing development (acres unknown), areas of recent high intensity wildfire (two acres), and the planned shelterwood removal (100 acres) on private land, have contributed cumulative effects to Potential sensitive fungi. These activities have removed or altered habitat. While local extirpations may have occurred, these losses do not constitute a trend toward federal listing or loss of viability due to a) potential for sensitive fungi to occur in undisturbed stands surrounding logged or intensely burned areas, b) ability of spores to move into a disturbed area from the surrounding forest and persist as mycelia underground and c) the broad geographic distribution of these species south of the project area and into the Pacific Northwest.

Conclusion: Documented Sensitive Plant Species and Potential Sensitive Fungi Species

No Action Alternative: Early seral species such as *Thermopsis robusta*, which appear to require disturbance to germinate and grow, would remain stable in the short term. A sustained period without disturbance (natural or human-caused) may lead to local extirpations in the long-term and little opportunity for expansion of occurrences. Effects to other sensitive plants and fungi species are not anticipated.

Proposed Action Alternative:

Documented Sensitive Plants

- A no disturbance buffer within a 25-foot radius around the documented occurrence of *Buxbaumia viridis* and the occurrence's association with a riparian area would alleviate concerns for any direct or indirect effects to *Buxbaumia viridis*. There are no direct, indirect, and thus no cumulative effects for *Buxbaumia viridis* from the OCFR project.
- Retention of overstory and subcanopy trees and the no disturbance buffer would alleviate concerns for any direct or indirect effects to *Sulcaria badia*. There are no direct, indirect, and thus no cumulative effects for *Sulcaria badia* from the OCFR project.
- No disturbance buffers within a 25-foot radius around documented occurrences of *Ptilidium californcium* would alleviate any potential direct effects. Retention of 60% canopy cover within 50 feet around documented occurrences will reduce potential indirect effects at the stand level. Cumulatively, past activities associated with clearcuts, patch cuts, shelterwood or seed tree cuts have contributed cumulative effects to *Ptilidium californicum* (PTCA) by removing or substantially altering habitat conditions for PTCA. Thinning in Donahue Units 142 and 146 may lead to loss of PTCA individuals associated with these units. These effects however, would not constitute a trend toward federal listing or loss of viability due to 1) the expected persistence over time of 11 occurreces (15 occupied trees) of PTCA distributed across the northern and central portion of the project area, b) the probably existence of PTCA in the suitable habitat between the project area and the Blue Creek Watershed where PTCA is documented, thus providing connectivity between the two areas, c) the Klamath Mountains being the geographic center of PTCA in California and d) the distribituion of PTCA in the Pacific Northwest where it is not considered a rare species
- No disturbance buffers around *Thermopsis robusta* occurrences would alleviate any potential direct effects with the exception of the potential to affect a proportion of the occurrence in Unit 142. Indirect effects are expected to benefit *Thermopsis robusta*. Cumulatively, response of *Thermopsis robusta* to past activities or events would be opposite that of PTCA in that the habitat for *Thermopsis robusta* is early seral. Where *Thermopsis robusta* is found, it is associated with roadside settings, landings, skid trails and high intensity burned areas. Cumulative effects of past, present and foreseeable actions on *Thermopsis robusta* have likely been or would be positive in nature.

Potential Sensitive Fungi Species

There is potential for direct and indirect effects to Sensitive fungi. Cumulatively, past activities on 1,300 acres, landing development, high intensity wildfire and planned shelterwood removal (100 acres) on private land, have contributed cumulative effects to Sensitive fungi. While local extirpations may have occurred, these losses would not constitute a trend toward federal listing or loss of viability due to a) the potential for Sensitive fungi to occur in undisturbed stands surrounding the logged or intensely burned area; b) the ability of spores to move into a disturbed area from the surrounding forest and persist as mycelia underground and c) the broad geographic distribution of these species south of the project area and into the Pacific Northwest.

Matsutake Fungi

Habitat components for matsutake fungi would be retained in the stand. Impacts would be short-term. Impacts resulting from ground disturbing activities such as skidding or road construction would be localized and may sever underground mycelia but would not be expected to impact the entire body of the fungus. Complete clearings over 0.5 acres in the wake of land/disposal site development or past clearcuts, patch cuts, shelterwood cuts and seed tree cuts would eliminate matsutake habitat at least in the short-term until the area develops into a mature forest stand.

Determination: With the aforementioned project design features in place, the proposed action alternative would not affect *Buxbaumia viridis* or *Sulcaria badia*. It is my determination that with the project design features, the OCFR project may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for *Ptilidium californicum, Thermopsis robusta, Boletus pulcherrimus, Dendrocollybia racemosa, Phaeocollybia olivacea or Sowerbyella rhenana.*

Required Disclosures for Northwest Forest Plan Survey and Manage Species

A January 9, 2006 court order (NEA et al. vs. Ray et al., Civ. No. 04-844P) concluded that ground-disturbing activities need to comply or demonstrate consistency with the 2001 Record of Decision (ROD) and Standard and Guidelines for Survey and Manage Species (USDA and USDI 2001) as amended by the 2003 Annual Species Review, Table 1-1. Species Included in Survey and Manage Standards and Guidelines and Category Assignment December 2003). Compliance with the 2001 ROD as amended by the Annual Species Review was affirmed by a February 18, 2008 Ninth Circuit Court order that concluded the 2007 Survey and Manage Final Supplemental Environmental Impact Statement satisfied the condition set forth by a February 12, 2007 Ninth Circuit Court decision pertaining to two Bureau of Land Management timber sales (Cottonsnake and Cow Catcher). The February 18th order thus vacated the February 12th order.

Consistency with the 2001 ROD as amended includes application of existing Management Recommendations to any known sites of survey and manage species potentially affected by project activities and pre-disturbance surveys for those species listed as Category A or C (USDA and USDI 2001).

Botany

From a botanical perspective the project complies with the 2001 ROD in that (a) pre-disturbance surveys were conducted for those Category A or C species with ranges and potential habitat overlapping the project area (Table 28), (b) measures are provided for the persistence of the species detected, and (c) management is provided for known sites of Category B and Category E species (Table 29). Supporting information on the survey-and-manage species for this project can be found in the specialist report (Hoover 2008).

Table 28. Category A and C Survey & Manage Species in 2001 Table 1-1 (as amended) considered for pre-disturbance surveys in this project

Species	Species Group
Cypripedium fasciculatum	Vascular plant
Cypripedium montanum	Vascular plant
Leptogium cyanescens	Lichen
Lobaria oregana	Lichen
Ptilidium californicum	Bryophyte

Fourteen sites of *Ptilidium californicum* (PTCA), one site of *Buxbaumia viridis* and one site of *Lobaria oregana* (LOOR) were located during the course of pre-disturbance surveys. *Ptilidium californicum* and *Buxbaumia viridis* are also Sensitive species and are addressed as such in the Biological Evaluation and Sensitive species section of this document. *Lobaria oregana* is a foliose lichen that was found as litter fall in Unit 226. Its substrate was assumed to be a nearby mature Douglas-fir tree.

Review of the known sites database associated with the Survey and Manage Program indicated the presence of known site for both *Chaenotheca ferrugina* and *Chaenotheca pusilla* on the bole of one tree in unit 166.

Table 29. Category B and E Survey & Manage Species in 2001 Table 1-1 (as amended) known to occur or located in the project area

Species	Species Group
Buxbaumia viridis	Bryophyte
Chaenotheca ferrugina	Vascular plant
Chaenothica pusilla	Lichen

Project design features include maintenance of the occupied substrate and establishment of no disturbance buffers of 25' radius around the substrates of all sites of Survey and Manage botanical species.

In addition to the 25' no disturbance buffer around all known and detected sites of PTCA, project design features at the stand-level include maintenance of 60% canopy closure within a 50' radius of around the individual trees occupied by PTCA. Exceptions to the maintenance of 60 percent canopy closure pertain to three known sites of PTCA within two units where existing canopy cover at these sites is an estimated at 40% as a result of past thinning. This current condition in the canopy cover has likely affected such local conditions as increased wind speed, solar radiation, air temperature, and thus resultant drying effects. Understory shrubs surrounding the base of the occupied trees where PTCA occurs will not be disturbed; therefore, providing some protection against wind or light effects at the tree base where PTCA grows. Maintenance of 60 percent canopy closure, scattered hardwoods, and dominant and pre-dominant trees at a stand-level may also ameliorate effects, but uncertainty exists as to what degree, these and other measures will mitigate the potential effects of past thinning on local and long-term habitat conditions preferred by PTCA .

Fauna

With the 2003 Annual Species Review, the red tree vole was removed from management under the Survey and Manage Standards and Guidelines in the mesic survey zone of the species range which encompasses the Orleans Ranger District and therefore the OCFR planning area. With this removal, pre-disturbance surveys and site management are no longer required within the mesic zone.

With the 2003 Annual Species Review, mollusk species *Prophysaon coeruleum* is a Category A species in California and Washington, however to date this species within California has not been confirmed by California Malcologist expert, Dr. Barry Roth. There are 7 recorded detections within California and they are thought to be a misidentification and based solely on external color.

From 1999 to 2002, over 800 acres of pre-disturbance and strategic mollusk surveys where implemented to protocol on the Orleans Ranger District including areas overlapping with OCFR Project. Survey & Manage listed and non-listed mollusk species were detected and resulted in over 2000 mollusk detections; none were determined to be *P. coeruleum*.

According to Dr. Roth, *P. coeruleum* is not known to occur in Orleans or on the Ukonom Ranger District. Therefore, it is reasonable to assume that *P. coeruleum* does not occur on Six Rivers National Forest (based on negative outcomes from strategic surveys and pre-project survey results) and habitat is sufficient to support stable populations in the Northwest Forest Plan area.

Known sites of terrestrial fauna species in the project area are afforded protection by project design features including riparian reserve buffers, maintenance of a 60% canopy closure in suitable habitat, and litter and log retention guidelines. Furthermore, ninety-one percent of the Six Rivers National Forest is protected in reserve land allocations. All proposed activities adhere to LRMP Standards and Guidelines designed to minimize potential impacts to wildlife habitats.

No other survey-and-manage fauna species were considered in this project; therefore, OCFR is in compliance with the 2001 ROD as amended.

Conclusion: Survey-and-Manage Species Botany and Fauna

- OCFR is in compliance with the 2001 ROD as amended.
- **Under no action alternative**: Habitat conditions would not change as a result of management activities, thus species at known sites would be expected to persist. An exception may apply to current habitat conditions at 3 sites of PTCA in two units subject to past thinning where the current condition provides for little immediate canopy cover.
- **Under proposed action alternative**: No-disturbance buffers for botanical species as well as stand-level design features pertaining to maintenance of 60 percent canopy closure, retention of scattered hardwoods, shrubs ,logs and litter/duff across stands, would provide for persistence of survey-and-manage botanical and faunal species associated with OCFR. Habitat conditions for PTCA at 3 sites do not notably differ between the no action alternative and the proposed action. Design features at these sites aim to reduce the incidence of further changes in habitat conditions.

Environmental Concerns Regarding Noxious Weeds

Affected Environment

Scotch broom, french broom and yellow starthistle are Forest priority noxious weeds detected in the proposed action area in association with roadsides and previously disturbed areas. Roadside and disturbed area occurrences are prevalent along the lower stretches (i.e., within three miles of State Highway 96 and the Klamath River corridor) of the primary access routes for the project area (15N01, 13N18, 11N11 and 10N13). Relative to the proposed units, noxious weeds were documented proximal to Units 7, 11, 14 and 42. These units are in the southern portion of the project, south of the Klamath River.

Higher in the watershed, away from major road corridors, noxious weeds are less evenly distributed, occurring more as discrete occurrences (e.g., less than 0.5 acre in size). In the middle to upper watershed locations, noxious weeds are associated with or proximal to old landings, private property inholdings, and specific road sections.

Noxious weeds have an enormous capacity to spread into newly disturbed areas and proliferate. Through their reproductive capacity, growth habit, methods of dispersal and seed bank capacity, noxious weeds readily displace native plant species and persist in the environment. For example, seeds of broom species exist in the soil (termed “seed banking”) until the soil is adequately disturbed or up to 30 years. Yellow starthistle develops a taproot early in the growing season thereby exploiting water resources early in the growing season at the expense of native species. In addition, one plant of yellow starthistle can produce anywhere from 1,000 to 75,000 seeds (DiTomaso and Gerlach 2000).

Once established, noxious weeds can spread into adjacent disturbed areas. Such is the case in the lower watershed which is relatively developed and near a major east-west weed corridor—Highway 96. Inadvertent weed introductions higher in the watershed are often caused by weed seed import on equipment or vehicles that have been operating in an infested area, or the use of weed seed infested gravel or other foreign material. Weed seed imported on equipment or vehicles that come in contact with disturbed soil would readily germinate and if left untreated would become established and spread where conditions are suitable. Infested gravel or other materials used in road maintenance or private land developments becomes a primary source of weed seed introduction which subsequently germinates and spreads from the source along roadways that are chronically disturbed.

Alternative 1 - No Action

Direct and Indirect Effects

Under the no action alternative, there would be no direct effects since no activities would occur. However, indirect effects could occur without active management of existing noxious weed populations. Given baseline conditions described above about the current distribution of noxious weeds and the vectors for potential introduction outside the scope of this project (e.g., routine road maintenance, private property developments), if left unmanaged, the extent and density of existing noxious weed populations would increase, with the lower watershed locations in the project area being the most vulnerable due to the concentration of developments in this area and proximity to State Highway 96.

Regardless of location in the watershed, if the ground adjacent to an existing population is disturbed and there is no vegetative competition and canopy cover is limited, noxious weeds can become established on disturbed ground. It is this latter situation that distinguishes the likelihood of indirect effects of Alternative 1 from Alternative 2, in that the former does not propose ground disturbing activities beyond what is considered baseline while the proposed action will result in the creation of settings (i.e. landings) where noxious weeds can spread.

Alternative 2 - Proposed Action

Direct and Indirect Effects

No direct effects are anticipated under the proposed action alternative. Indirect effects pertain to the incremental loss of native plant species which reduces the capacity of plant communities to provide ecological services--- forage for wildlife species, water and nutrient cycling, soil productivity, and possibly cultural services as well—displacement of culturally significant plant materials.

Indirect effects are presented below in terms of risk of weed introduction and spread. Low risk situations include sites with overstory shade and competing understory vegetation, no heavy equipment use, and minimal chronic disturbance anticipated. In contrast, high risk situations are those with no overstory shade or competing vegetation, heavy equipment use, known weed occurrences, and expected chronic disturbance.

Overstory canopy removal, understory vegetation removal, soil disturbance, heavy equipment use, import of foreign material, and the proximity of known weed sites to ground-disturbing activities are all factors that influence the risk or likelihood of noxious weed introduction and spread. Variables surrounding these factors pertain to their extent and magnitude. Likewise, the indirect effects of the proposed action would vary by activity, specifically thinning, fuel treatments, logging method, road construction/reconstruction and landing development/redevelopment.

Forested settings, in the mature seral stages, are not likely to support habitat for such shade-intolerant weeds as scotch broom, french broom and yellow starthistle. Sixty-two percent (62 percent) of the proposed action area consists of units in the mature seral stages. Thinnings proposed in mature stands would maintain a minimum 60 percent canopy closure (with the exception of unit 203, which was previously thinned). Fuel treatments in the understory of mature stands would leave patches of shrubs and trees scattered throughout the unit. The retention of shade and pockets of competing vegetation in the unit as a result of thinning and fuels treatments lowers the risk or reduces indirect effects of these activities on the spread of noxious weeds into the unit to a negligible level.

Depending on the amount of canopy cover and stand density retained after thinning, plantations may provide suitable habitat for noxious weeds. The suitability increases in younger plantations in the pole-shrub seral stage where there is little to no canopy cover (38 percent of the proposed action area). In addition to their potential habitat suitability for noxious weeds, sites of past logging are often sites of documented weed sites. Noxious weeds have been documented in association with old clearings proximal to Units 7, 11, 14 and south of Unit 42. Proximity of known weed sites to plantations proposed for thinning may result in noxious weed introductions in the short-term. As crown density increases over time, noxious weeds plants would be shaded out. However, if the seed bank is still viable, subsequent ground disturbance and canopy opening could stimulate weed seed germination long after the adult plants are no longer present. The indirect effect of thinning young plantations is the moderate risk of introducing weed seed into the unit.

Activities pertaining to endlining, tractor skidding, new temporary roads, and road reconstruction would disturb the soil in the mature seral stage units and clear vegetation in the wake of ground disturbance. These activities as well as road decommissioning also require the use of heavy equipment, within the unit, thus a potential to inadvertently introduce weed seed. In units with 60 percent resultant canopy cover after thinning, adjacent trees would provide peripheral shading over the skid trails and roads, reducing the suitability of the disturbed sites for noxious weeds. Furthermore, project design features (Appendix C) that limit skid trails to 15 percent of the unit area, require equipment cleaning prior to entry into the proposed action area would further reduce the risk of weed seed introduction and spread. With project design features in place, the indirect effects of these activities on the introduction of noxious weed seed into the mature seral stage units are lowered to a negligible level.

Creation of new landings/disposal sites or reconstructing existing landing/disposal sites pose the highest risk of weed introduction and spread. This risk level is due to the magnitude and extent of complete vegetative clearing and the concentration of heavy equipment operating at these sites. The proposed action includes 158 landing/disposal sites of which 60 are new construction. Of those, seven are helicopter-related landings from one to two acres in size with no potential for adequate peripheral canopy shading. In addition to the magnitude in extent of vegetative clearing and heavy equipment use, new landings/disposal sites in the upper watershed areas would create highly suitable habitat for new weed introductions in an area where none exist. The indirect effect of developing new landings/disposal sites and reconstructing existing landings/disposal sites is the high risk of noxious weeds spreading onto these sites and the high risk introducing noxious weed occurrences to a currently uninfested area.

Project design features specific to landings/disposal sites include treatment of existing weed sites at existing landings, equipment cleaning before leaving infested landings, and revegetation around logging slash after landing have been ripped (Appendix C). These features aim to reduce the indirect effects resulting from landing development but given the vulnerability of such a highly disturbed setting to inadvertent noxious weed introduction and spread, the effects are still considered moderate to high.

Cumulative Effects

No Action and Proposed Action

The spatial context for cumulative effects analysis coincides with the project area and the private lands (3791acres) therein or adjacent to the project area and connected by a road. In keeping with the spatial scale, the temporal context for assessing past activities would coincide with the timing of those activities occurring within that spatial context.

Past activities (Appendix D - Table D-1) associated with a) clearcuts, patch cuts, shelterwood or seed tree cuts on public land, b) past fire salvage on public land, c) landing developments on private land, and d) residential or agricultural related clearings on private land have likely contributed cumulatively to the introduction and spread of noxious weeds. Foreseeable future activities associated with a) OCFR landing developments and heavy equipment use b) use of heavy equipment for decommissioning roads as a part of the Orleans Transportation and Road Restoration Project on public land, c) the proposed shelterwood removal on private land (Appendix D - Table D-2), and d) ongoing private land developments, are expected to cumulatively affect the introduction and spread of noxious weeds. These types of activities provide suitable habitat and conditions for weed establishment (i.e. little to no overstory, disturbed ground, removal of competing vegetation) and weed seed vectors associated with heavy equipment.

Given the presence of noxious weeds within the project area, the vulnerability of old landing and plantation sites, the complete clearing for new landings, repeated disturbance on former landings, the use of helicopter and ground-based equipment, and the developments or activities

associated with private lands in and adjacent to the project area, the risk of weed introduction and spread is considered high.

For any project having a moderate to high risk of introducing or spreading noxious/invasive weeds, the project decision document must identify noxious weed control measures that would be undertaken as a part of project implementation. These design features (Appendix C) are incorporated into the decision document to reduce the risk of introduction and spread of noxious weeds.

Conclusion: Noxious Weed Populations

No Action Alternative: If left unmanaged, the extent and density of existing noxious weed populations would increase, with the lower watershed locations in the project area being the most vulnerable. Rate of new spread and new introductions would be commensurate with baseline activities such as private property developments and road maintenance.

Proposed Action Alternative:

- Given the presence of noxious/invasive weeds within the project area, the habitat suitability of early-seral plantation, the complete vegetative clearing for new and existing landings, the use of helicopter and ground-based equipment on those landings, and activities on private lands, the risk of weed introduction and spread is considered high relative to these settings and activities.
- Project design features (Appendix C) have been incorporated into the project design to reduce the risk of introduction and spread of noxious weeds.

Social Concerns Regarding Recreation and Scenic Viewsheds

Affected Environment

Low, moderately steep mountainous terrain, bisected by numerous side drainages, faces the Klamath River as it winds through the Klamath Mountains. In the background, higher elevation ridges and peaks provide a visual backdrop. Vegetation is most often a continuous mixed conifer forest, with some patchiness from old timber harvest activities, rock outcrops, and limited hardwoods interspersed throughout the conifers. Some forest areas are excessively dense, obstructing in-canopy views to forest floor and other attractive features, and also increasing the forest risk of extreme wildfire events that could be adverse to valued landscape character attributes.

High Visual Sensitivity viewsheds include: Hwy 96 (Bigfoot Scenic Byway) and the Klamath National Wild and Scenic River. Moderate Visual Sensitivity viewsheds include: Bark Shanty Road, Ishi Pishi Road, Go Road, Red Cap Road, and the Prospect Trail.

High Sensitivity Viewshed

A High Sensitivity Viewshed is defined as: 1) a primary road, trail, or use area where at least 1/4 of the users have a major concern for scenic qualities, or 2) a secondary road, trail, or use area where at least 3/4 of the users have a major concern for scenic qualities.

Moderate Sensitivity Viewshed

A Moderate Sensitivity Viewshed is defined as a primary road, trail, or use area where at least 1/4 of the users have a major concern for scenic qualities, or a secondary road, trail, or use area where at least 1/4 and not more than 3/4 of the users have a major concern for scenic qualities.

Retention

Viewsheds with a VQO of retention will have a natural appearance as seen from the viewing location

Partial Retention

Viewsheds with a VQO of partial retention generally a near natural-to natural landscape would appear

Viewing natural features (scenery) is the second most sought after recreation activity on the Six Rivers National Forest, and also contributes indirectly to local quality of life, tourism and economic vitality. Scenic quality within the project area is important to the people who live and work in the area, and travel through the area enjoying views from Highway 96 (Bigfoot Scenic Byway) travel corridor, the Klamath River, various County and Forest roads, and the rural community of Orleans. The scenery of the area contributes a small but important part to the Six Rivers National Forest's scenic heritage.

Other recreation use in the project area consists primarily of dispersed-type recreation, including swimming, fishing, whitewater rafting, hunting, and woodcutting. There is one developed campground in the project area – Perch Creek, which received light use, and there are several river accesses – Ikes Falls, Whitmore Creek, Dolans Bar and Ullathorne. Because scenery affects the recreation setting and experience, this report will focus scenery effects.

Management Area 13 - Retention Visual Quality Objective (VQO) areas on the Forest are located primarily within the foreground of State Highway 36, 96, 199, and 299. Viewsheds with a VQO of retention will have a natural appearance as seen from the viewing location. Although the quality of scenery from the viewing locations may be affected by activities on private lands, the direction for the management area applies only to National Forest lands. Timber harvest may occur in retention areas to create visual diversity and enhance the visual resource.

Within Management Area 15 - Recreational River management area, management activities, including timber harvesting, may be evident at some locations, but within the foreground view, these activities would meet the partial retention VQO and would remain visually subordinate to the characteristic landscape. Within Management Area 16 – Partial Retention typically applies to middle ground and background viewing areas as seen from highly sensitive viewing areas, or foreground areas as seen from moderately sensitive viewing locations such as county roads, streams or trails." Harvest activities may be visually apparent to the Forest visitor but would not dominate the viewed landscape. Generally a near natural-to natural landscape would appear. Design features have been added to the proposed action alternative to achieve a VQO of partial retention within the recreational river corridor and in middle ground areas visible from the recreational river corridor (Appendix C).

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Cumulative effects have been defined in time and space by the following: (1) the timeframe is the past 30 years and 10 years into the future; (2) the scenery analysis area, which includes the multitude of viewsheds throughout the project area, is the same as the watershed boundaries identified in the Cumulative Effects Boundary Map (Appendix A). The projects considered for cumulative effects are in Appendix D. Cumulative scenic quality effects have been evaluated in a larger context than the individual project activities themselves - the potentially affected viewsheds as a whole. Under the no action alternative, there would be no fuels reduction treatments, including road building or landing construction. Visual Quality Objectives (VQOs)

establish acceptable levels of alteration for management activities. There would be no changes to the Visual Quality Objectives or to Scenic Integrity.

The landscapes being viewed have Moderate to High Scenic Integrity (meeting Partial Retention to Retention VQOs cumulatively). As one moves through the area, the landscape appears slightly altered because of minor contrasts from old vegetative alterations. This existing condition is expected to stay the same or actually improve over the long term as these alterations grow back in under the no action alternative.

Alternative 2 – Proposed Action

Direct and Indirect Effects

As seen from the Klamath National Wild and Scenic River, the three thinning Units 44, 218, 219, located within the river corridor would likely not be visible because of topographic and/or vegetative screening and viewer orientation downriver. They therefore meet Retention and exceed the minimum assigned VQO of Partial Retention.

All units located in the foreground distance zone meet or exceed the assigned VQO of Retention as seen from Highway 96 (Bigfoot Scenic Byway). All units located in a Partial Retention VQO area as seen from Highway 96 (Bigfoot Scenic Byway) also meet or exceed the Partial Retention VQO due to limited viewing duration, distance from activity, viewing angle, and retention of a minimum 40 to 60 percent canopy closure.

Project design features (flush cut stumps) have been incorporated in select units along the lower portion of Bark Shanty Road to meet the Retention VQO. All other units would meet the Partial Retention VQO.

Many of the units located in the south OCFR project units have limited visibility as seen from Highway 96, Red Cap Road, and the Klamath River. Viewing distance and angle, retaining 60 percent canopy closure, and topographic screening would allow the units with a Partial Retention VQO to meet or exceed the VQO. Units 1 and 2 were modified during project design to meet a Retention VQO.

All units located in areas with a Modification VQO would meet or exceed a Partial Retention VQO. Most units would not be visible from any inventoried sensitive viewpoint (i.e. Bark Shanty Road, Go Road, Ishi Pishi Road). Any unit that may be visible from Highway 96 would also exceed the Modification VQO by meeting Partial Retention due to limited viewing duration, distance from activity, viewing angle, and retaining a minimum 40 to 60 percent canopy closure.

The operational impacts from the project activities such as traffic, noise, dust, and smoke would be temporary in nature. Changes in stand structure and composition resulting from different treatments may result in some changes in recreational use patterns, but the same recreational opportunities would continue which is the very nature of dispersed recreation. There is no reason to expect recreation use to measurably increase or decrease as a result of this project.

Cumulative Effects

Cumulatively, all project activities would meet their assigned VQOs. All viewsheds would remain natural or near-natural appearing and appear visually subordinate to the characteristic landscape.

Other Required Disclosures for the Recreation and Scenic Viewsheds

Wild and Scenic Rivers

There are 34 acres within Units 44, 218 and 219 located within the Klamath Wild and Scenic River (WSR) corridor. Thus, the four characteristics of wild and scenic rivers as listed below must be maintained.

Free Flowing Conditions

As applied to any river or section of a river, means existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. Although there are three units proposed within the river corridor boundary, they are located several hundred feet upslope from the river and not proposed within the bed and banks of the Klamath WSR. Therefore, the proposed action alternative would have no effect on the free flowing conditions of the Wild & Scenic River, since no activities are proposed within the WSR bed or banks.

Water Quality

Consistent with the Clean Water Act, water quality in recreational river areas will be maintained or, where necessary improved, to meet Federal criteria or federally approved State standards for aesthetics and fish and wildlife propagation. The proposed action alternative complies with the ACS objectives, the North Coast Basin Plan, the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board waiver (Order No. R1-20044-0015). See Environmental Effects to Watershed, Water Quality, Riparian Reserves and Fisheries above).

Outstandingly Remarkable Value

Anadromous Fisheries: Each river shall be managed to protect and enhance the values for which the river was designated, while providing for public recreation and resource uses which do not adversely impact or degrade those values. Important Anadromous fish species include coho salmon, summer and winter-run steelhead, and fall and spring-run Chinook salmon. Some of species are state and federally listed as “endangered threatened” or regarded as “sensitive” species. The proposed action would not result in any direct effects to anadromous fish. Minor site-scale effects from the proposed action alternative would not change any of the key Indicators of aquatic habitat that serve as proxy for indirect effects to anadromous fish in the short term or long term. Therefore, anadromous salmonids and their critical habitat and essential fish habitat

(as noted above) found downstream from the nearest project action would not be adversely affected.

Forest WSR Standards and Guidelines

All Forest LRMP standards and guidelines will be met for this project. The disturbances associated with the project would (at a minimum) meet the Partial Retention Visual Quality Objective (VQO) within the river corridor and in middleground areas visible from the river corridor. For management activities to meet the Partial Retention VQO, the activity must remain visually subordinate to the characteristic landscape. The river waterway would remain generally natural and riverine in appearance.

Conclusion: Recreation and Scenic Viewsheds – VQO Standard

- **No Action alternative**: The landscapes being viewed have Moderate to High Scenic Integrity (meeting Partial Retention to Retention VQOs cumulatively). As one moves through the area, the landscape appear slightly altered because of minor contrasts from old vegetative alterations which are growing back in.
- **Proposed Action alternative**: Cumulatively, all project activities would meet their assigned VQOs. All viewsheds would remain natural or near-natural appearing and appear visually subordinate to the characteristic landscape. Most units would not be visible from any inventoried sensitive viewpoint (i.e., Bark Shanty Road, Go Road, Ishi Pishi Road, Highway 96).
- The operational impacts from the project activities such as traffic, noise, dust, and smoke would be temporary in nature. Changes in stand structure and composition resulting from different treatments may result in some changes in recreational use patterns, but the same recreational opportunities would continue.

Conclusion: Wild and Scenic Rivers

- **No Action and Proposed Action alternative**: Under both Alternatives Wild and Scenic River values including Free Flowing Conditions, Water Quality, and Outstandingly Remarkable Values would be maintained.

Social Concerns Regarding Economics

Affected Environment

Residents, Tribes, and communities that are within or adjacent to the OCFR project area, as well as other members of the public, use the area in a variety of ways, and value these lands for diverse reasons. Forest Service management of public lands affects these uses and values. Tribal governments and people are concerned about the management practices the Six Rivers National Forest may implement, particularly as they relate to access via roads and trails, potential catastrophic fires, quality of their lives and experiences, and local community economics and infrastructure.

The Orleans Community has four environmental organizations, two fire safe councils, and two watershed councils that serve this area, along with the local community and tribal membership of the Karuk Tribe. All are very interested and active in ongoing planning and management of the Orleans District.

The introduction of Roundtable Public Forums by the District in January of 2006 to seek input and understanding after initial Tribal consultation was started with the Karuk Tribe on the

OCFR project, has evolved into a developing partnership that would continue to grow to keep the community informed and District management transparent to all stakeholders.

At the heart of the social and political discussion centers on: What is the community and tribal capacity to sustain economic and cultural prosperity over time?

This section addresses present day social and cultural setting as influenced by the planning and implementation of OCFR project.

Alternative 1 - No Action

Direct and Indirect Effects

Under the no action alternative, only previously planned projects would provide jobs for the local community.. Local loggers and timber haulers would not be utilized. Local capacity to maintain an infrastructure to transport or utilize timber products for processing in and outside the local community would continue to decline.

Recreation, organic farming, several small service type businesses, and other individual enterprises, which are primarily natural resource based or provide services to those using natural resources in the area, would continue at present levels.

Cumulative Effects

The analysis area for cumulative effects to social and economic resources is the communities of Orleans and portions of the communities of Somes Bar and Weitchpec, California. The timeframe is the past 30 years and 10 years into the future. Somes Bar has a current population of nearly 125 people, and its main industries are organic farming, timber management, and recreation. Facilities in Somes Bar include a store/post office, an elementary school, a fire station, and residential areas. The current population of the community of Orleans is around 680.

The main industries are logging, recreation, organic farming, several small service type businesses, and other individual enterprises, which are mostly natural resource based or provide services to those using natural resources in the area. State, county, and federal government agencies, including a public elementary school, a county dump, and a California Department of Transportation facility, which houses equipment and a local crew of six to eight employees, also operate in and near Orleans.

The Forest Service maintains a facility for the Orleans Ranger District that includes the Ukonom District of the Klamath National Forest, which is administered by the Six Rivers National Forest. The Orleans Ranger District employs about 35 permanent employees, and hires between 20 and 30 employees in temporary, seasonal jobs. The majority of the employees live in the community providing economic and community support to the well being of the community. The town of Weitchpec, 13 miles to the south, has a population of 150. This community supports a store/gas station, an elementary school, and a church.

The economic stability in the community has fluctuated greatly historically. Tens of thousands of Euro-Americans flooded the area in the mid-1800s to mine gold, however, as the element became harder to obtain, gold mining vanished quickly, less than a generation after it had

started. The economy grew again in the first half of the twentieth century due to its reputation as a premier fishing destination with abundant runs of salmon and winter steelhead. This recreation-based industry has diminished in the second half of the twentieth century due to numerous factors, both natural and human-caused, that severely depleted stocks of these fish. After World War II, the area again flourished when the logging of Douglas-fir trees began locally. This boom continued until the late 1980s when regulations surrounding the Endangered Species Act and other resource protection measures resulted in the large timber companies having to look elsewhere for easily obtainable resources. Under the no action alternative, the economic stability in the community would continue to fluctuate.

Alternative 2 - Proposed Action

Direct and Indirect Effects

Approximately 1,294 acres would be commercially treated to produce commercial wood products to supply local mills within 3 to 5 years. Local loggers and timber haulers would be needed to support this work. Under stewardship contracting authorities approved by the Regional Forester in Region 5, potential bidders are required as they prepare their “best value” bid to disclose what local resources would be used to complete the thinning work and fuels cleanup on the ground. Thus, use of local contractors would be encouraged.

Treetops and activity fuels would be treated and yarded to landings, where they would be made available for use by the contractor or the public for firewood. The material would be available to the public after initial commercial harvesting is completed.

In all, approximately 2,698 acres of treatment would be implemented in the first decade as funding is obtained. The indirect social effects to the Orleans Community would be the retention and development of skills to complete the fuels treatments and subsequent burning maintenance activities in these stands over time.

Recreation, organic farming, several small service type businesses, and other individual enterprises, which are mostly natural resource based or provide services to the local workforce, would benefit from this work as well.

Cumulative Effects

Today, wood products that could result from thinning from below proposed in OCFR analysis are expensive to bring to market because of high fuel costs and loss of timber industry infrastructure to process the logs coming from the forest. The nearest mills for processing are over two and a half hours away in Yreka, Weaverville, and Eureka California. The community continues to lose the infrastructure to locally log larger thinning projects. In fact, skyline cable expertise to carefully remove trees in such a way to minimize soil disturbance and to enhance hardwood restoration is limited. Many local loggers have sold necessary yarding equipment and can only provide hauling services to the mills.

Firewood is still the most sought after wood product commodity by local residents to heat their homes. The cost of firewood by the chord has increased in cost during the 2007 and 2008

winter seasons. Bio-Mass utilization continues to be a focus for the community and some research has been conducted locally to explore options for bio-mass utilization. Under the proposed action alternative the community infrastructure and opportunities would improve.

Conclusion: Social Concerns regarding Economics

- **No Action Alternative**: The loss of infrastructure and skills in the community to support vegetation management would further reduce the ability of a small community like Orleans to reduce the fire risk and at the same time provide economic and social well being of the community. In the long-term, recreation, organic farming, several small service type businesses, and other individual enterprises, which are mostly natural resource based or provide services to the local workforce benefiting from this work, would be still needed. The need for Roundtable Public Forums to maintain collaborative discussions and transparency of District management activities would lose momentum and restoration efforts by the District could suffer.
- **Proposed Action Alternative**: Infrastructure and skills to support vegetation management as proposed would be retained and expanded to contribute to economic growth and social well-being of the community. In 20 years, some commercial stands thinned as a result of implementation would be available again for commercial entry. Just as important, the desire of the community to share in responsibility for success of this project would continue to evolve and more partnerships and opportunities developed to use forest wood products available within the OCFR project area.

Other Required Disclosures Related to the Social Concerns Regarding Economics

Economics

A financial efficiency analysis was conducted for the project as required by Forest Service Handbook 2409.18 (USDA FS 2002). This section summarizes the results of the analysis; the full analysis is contained in the project file.

Present net value (PNV) is a measure of economic efficiency used by the Forest Service that provides one index for comparing alternatives. PNV is determined by deducting the present value of costs from the present value of revenues associated with a project. Costs include those associated with preparing and implementing a given project alternative; they do not include planning costs as these do not vary by alternative. Revenues include the value of products and uses amenable to monetary quantification (commodities with established market values, like timber); revenues are not assigned to non-quantifiable resources such biodiversity, wildlife, clean air, and water. Revenues and costs over time are discounted to the present at a four percent rate of return (present value).

Present net value can be either positive or negative depending on the balance of revenues received versus costs incurred over the life of the project. The alternative that produces the highest PNV is the most economically efficient solution. The reduction in financial PNV relative to the alternative with the highest PNV also represents the financial trade-off, or opportunity cost, of implementing a given alternative.

Revenues incorporated in the financial efficiency analysis include estimated total harvest revenue, purchaser BD deposits to burn harvest generated slash, and purchaser road maintenance

and surface replacement deposits. Costs include timber sale preparation and administration, purchaser and Forest Service fuel treatments in both commercial and noncommercial treatment units, decommissioning of one non-system road, and deferred road maintenance and surface replacement.

In order to assess potential revenues, those treatment units in which merchantable timber volume would be harvested and removed are analyzed as a traditional timber sale. It is assumed that the timber sale purchaser would perform any manual fuel treatments such as hand piling, pulling slash away from leave trees, and handline construction that are prescribed for these units.

The time period over which activities are expected to occur is 2008 through 2018. Sale preparation would occur in 2008. Commercial harvest operations and manual treatment of harvest generated fuels (hand piling, pulling slash away from leave trees, and handline construction), and manual treatment of sub-merchantable materials (felling, removal or hand piling, pulling slash away from leave trees, and handline construction) would occur in 2009. Pile burning and jackpot burning would occur in 2010, underburning would occur from 2010 to 2018. Decommissioning of a non-system road between CO. Rd. 8Q100 and FS Rd.13N10 would occur in 2011. Deferred road maintenance and surface replacement would occur in between 2014 and 2018.

Timber Sale Values and Costs

Treatment units in which merchantable conifers (greater than or equal to 8 inches DBH) would be harvested and removed were analyzed using the Timber Sale Economic Evaluation program (R5_SALE_EVAL V 2.0 – R5 – January 2008) to determine potential harvest revenues and timber sale viability (i.e., whether or not a purchaser would bid on a timber sale). This program uses estimates of current values and costs to determine the projected total timber value, and the total timber value at base rates. Base rates are the minimum values at which timber can be sold. A sale is considered economically viable when the projected total timber value exceeds the total value at base rates. This analysis assumes that all units with merchantable volume would be sold under one timber sale.

Delivered Log Value

Delivered log value is based on average prices for the northern region of California as of May 2008. Approximately 95 to 97 percent of the merchantable volume to be harvested is Douglas-fir. Therefore, for this analysis it is assumed that 100 percent of the volume harvested is Douglas-fir. The estimated delivered log value for Douglas-fir is $375/MBF.

Costs

Key costs incorporated in the analysis include logging and hauling, specified road construction, temporary road construction and post-harvest decommissioning, purchaser road maintenance, purchaser fuel treatments, BD deposits, and road maintenance/surface replacement deposits. Table 30 lists the volumes and key cost elements used in the Timber Sale Economic Evaluation program.

Table 30. Timber sale volume and key cost elements

Value/Cost Element	Unit	Ground	Endline	Skyline	Helicopter
Acres	Acre	776	34	151	269
Estimated Volume	MBF	3,707	161	1,165	2,064
Logging Cost	$/MBF	$188	$235	$275	$500
Haul Cost	$/MBF	$89.14	$89.14	$89.14	$89.14
Specified Road Cost	$/MBF	$3.38	$3.36	$0.00	$0.00
Temporary Road Cost	$/MBF	$4.42	$0.66	$8.14	$0.00
Purchaser Road Maintenance Cost	$/MBF	$4.83	$31.23	$4.68	$2.71
Road Maintenance and Surface Replacement Deposit	$/MBF	$8.21	$7.00	$5.98	$8.49
Purchaser Fuel Treatment Cost	$/MBF	$11.62	$10.48	$29.38	$67.12
Purchaser BD Deposit	$/MBF	$22.30	$18.86	$76.46	$42.96

Logging and Haul

Logging cost by logging system is based on input from local operators and the average costs used in developing the California State Board of Equalization Harvest Value Schedules for the period of January 1 through June 30, 2008 in Timber Value Area 1 (TVA1 - Humboldt, Del Norte, and southwestern Trinity counties). Average logging costs are $188/MBF for tractor (ground), $275/MBF for skyline, and $500/MBF for helicopter. For volume to be endlined, the logging cost is $235/MBF (tractor cost plus 25 percent).

Haul cost is based on an average one-way haul distance of 100 miles (200 miles round trip), with an average of 4 MBF hauled per load.

Specified roads

The cost of constructing new specified roads in order to log/haul merchantable timber volume is $15,000 per mile. These roads will be added to the Forest Service transportation network.

Temporary Roads

Temporary road costs include the cost of constructing new temporary roads or reconstructing existing temporary roads, and decommissioning these roads once logging/hauling is completed. The average cost for new temporary road construction/decommissioning is $19,500 per mile; the average cost of existing temporary road reconstruction/decommissioning is $4,600 per mile.

Road Maintenance

Road maintenance costs include work performed on Forest Service system roads by the purchaser during harvest operations such as pre- and post-haul surface blading, brushing of roadside vegetation and dust abatement, and deposits paid to the Forest Service to cover the cost of future road maintenance and surface replacement work as these needs are identified. Road maintenance costs are based on the amount of timber volume hauled across Forest Service system roads.

Fuel Treatments

Fuel treatment costs include work performed by the purchaser during harvest operations such as yarding unutilized material (YUM), yarding tops (YT), hand piling harvest generated fuel, pulling slash away from leave trees, handline construction, and deposits paid to the Forest Service (BD deposit) to cover the cost of burning harvest generated fuel. The average costs for post harvest fuel treatments are $550/acre for hand piling, $35/acre for pulling slash and $25/chain for handline construction (1 chain = 66 feet). Total BD cost is based on prescribed post harvest burning treatments; $440.20/acre for burning piles, $262.70/acre for jackpot burning, and $781/acre for underburning.

Forest Service Costs

The Forest Service would treat brush, sub-merchantable conifer and hardwood trees (less than 8 inches DBH), and existing fuels on up to 1,943 acres between 2009 and 2011. Approximately 1,307 acres have no merchantable timber volume to offset the costs of treatment; approximately 636 acres of additional treatment would occur in units having merchantable timber volume. Treatments include cutting of brush, submerchantable conifers and hardwoods, removal or hand piling of felled materials, handline construction, pulling slash away from leave trees, burning piles, jackpot burning, and understory burning. Table 31 provides a summary of Forest Service vegetation/fuel treatments and costs for 2009 through 2011. Maintenance burning (understory burning) would occur on approximately 2,407 acres between 2012 and 2018.

Table 31. Summary of Forest Service vegetation/fuel treatments and costs for 2009 through 2011

Activity	Unit	Total Units	Total Cost	Cost/Unit
Cutting Brush and Sub-merchantable Trees	Acre	1943.3	$558,687	$287.50
Removing Sub-merchantable Trees	Acre	671.4	$347,450	$517.50
Handline Construction	Chain	603.6	$17,353	$ 28.75
Pulling Slash from Leave Trees	Acre	226.5	$9,117	$ 40.25
Hand Piling	Acre	1259.6	$796,697	$632.50
Burn Piles	Acre	1259.6	$449,047	$356.50
Jackpot Burn	Acre	299.4	$63,697	$212.75
Understory Burn	Acre	187.4	$118,531	$632.50
Total			**$2,360,579**	

Under the no action alternative, no treatments would be conducted, therefore no value would be realized or costs incurred. This alternative would rank first in terms of financial efficiency with a PNV of $0.

Under the proposed action alternative, approximately 2,698 acres of vegetation and fuel treatments would occur over the next 10 years. This alternative would rank second in terms of financial efficiency with a PNV of -$4,118,240. The opportunity cost associated with implementing this alternative would be $4,118,240.

Total PNV for the proposed action is negative primarily due to the fact that monetary benefits (revenues) cannot be assigned to treatments that would occur regardless of whether or not

merchantable timber volume is harvested as part of the project. This does not mean, however, that there are no future benefits associated with these treatments. The primary benefit would be the reduction of fuel loading, and a lower risk of catastrophic fire, in forest stands adjacent to private property in the Orleans community.

Conclusion

The Forest Service would not be able to sell the merchantable volume associated with this project under one timber sale due to the fact that purchaser costs associated with logging, hauling, road construction and decommissioning, purchaser fuel treatments, BD deposits, and road maintenance/surface replacement deposits exceed the value of the merchantable timber at the mill. The estimated value to the purchaser would be -$834,891. This is due, in part, to (1) a relatively low delivered log price for Douglas-fir (currently $375/MBF) and (2) the high costs associated with helicopter logging.

However, opportunities listed below exist to improve the economic viability of the sale of merchantable volume and to increase harvest revenues that could be used to fund other fuel treatments.

1. Log prices fluctuate on a daily basis. Over the past year, average delivered log prices for Douglas-fir have ranged from $345/MBF to over $500/MBF. Deferring the sale of merchantable volume until the delivered log price is at least $513/MBF would produce a viable timber sale and estimated harvest revenues of $144,495. The PNV under this scenario would be -$3,173,793.
2. Helicopter logging costs (average $500/MBF) are high relative to that of tractor (ground) and skyline logging (average of $188/MBF and $275/MBF respectively). Prescribing hand treatments only (cutting brush and sub-merchantable trees, hand piling, burning piles) in those units currently designated as helicopter would improve the viability of the commercial portion of the project, yet still result in an estimated value to the purchaser of -$71,871. However, deferring the sale of merchantable volume under this scenario until the delivered log price is at least $410/MBF result would result in a viable timber sale and estimated harvest revenues of $104,284. The PNV would be -$3,350,029.

Other Required Disclosures: Social Concerns regarding Economics

- **No Action Alternative**: There would be no revenues or costs associated with this alternative.
- **Proposed Action Alternative**: The estimated value to the purchaser would be -$834,891. This is due, in part, to (1) a relatively low delivered log price for Douglas-fir (currently $375/MBF) and (2) the high costs associated with helicopter logging.

Environmental Justice

Executive Order 12898 relating to environmental justice requires an assessment of whether minorities or low-income populations would be disproportionately affected by proposed actions.

An environmental justice concern arises when conduct or action may involve a disproportionately high and adverse environmental or human health effect on identifiable low-income or minority populations. To determine this, an analysis was conducted on potential impacts to work opportunities, subsistence consumption and human health and safety. The outcome of this analysis was based primarily on current socio-economic information found in the LMK Watershed Analysis (pg. 3-131 to -133) and the Social/Economic Environment section of the LRMP FEIS (p. III-75).

The local Indian tribes and general public were notified of this project early in the process and provided an opportunity to provide comments by way of tribal consultation before the Roundtable public participation process, which began in fall of 2006 and as described in Chapter 1 of this document. Extensive comments came in from the Tribe. Of great interest to the Karuk Tribe is the Panamnik World Renewal Cultural District.

The south zone of the proposed project falls within the Panamnik World Renewal Cultural District. The project objectives and design features have been developed in coordination with the Karuk Tribe to protect the cultural and spiritual values of this portion of the project area. By incorporating certain design features into the proposal, the proposed action alternative would not have any significant adverse effects to existing cultural or spiritual uses. In fact, the project has been developed to enhance many conditions on the landscape for the benefit of traditional and spiritual uses.

The objectives and design features of the proposed action were developed in coordination with the Karuk tribe to enhance the cultural and spiritual values of the area. Implementation of the project would result in enhancement of these values.

Anticipated effects on minorities or low-income people are variable with the no action alternative. Not creating any new work opportunities could disproportionately affect low-income populations in the Northern Western Humboldt, County. Subsistence consumption is anticipated to improve with the Action Alternative because of focused vegetation management and fuels treatments proposed. The risks to human health and safety are not expected to change from the current condition under the no action alternative.

The proposed action alternative could provide new short-term work opportunities that could benefit low-income populations in the Mid Klamath Basin. Also, the action alternative would avoid adverse impacts to public safety through expert project design consistent with all laws and regulations. The proposed action alternative would include standard public health and safety clauses in all contracts. Actions such as dust abatement, signing of roads identifying the area as an active timber sale, safely securing truckloads, and maintaining the haul route, are standard precautionary measures. Subsistence consumption is not expected to change from the current pattern.

In conclusion, there are no environmental justice concerns affecting human health or the environment that would have an adverse effect on minority or low-income populations through the implementation of the action alternative considered in this FEIS. Conversely, the no action alternative, by virtue of not creating any new work opportunities, could disproportionately

adversely affect low-income and minority populations living in this river dominated remote areas within the Mid Klamath Basin.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short-term uses, and their effects, are those that occur within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained-Yield Act and the National Forest Management Act, all renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if the long-term productivity of the land is maintained. This long-term productivity is maintained through the application of the project design features described in Appendix C, in particular those applying to the soil and water resources.

Under the proposed action, there would be a very short-term increase in fuel hazard in the period between harvesting and activity fuel treatment. This would be accompanied by a long-term increase in stand vigor, a reduction in fuel hazard, and a corresponding decrease in the risk of stand-replacing fire occurring within the harvest units. There would also be a 3- to 5-year increase in fuel hazard from post-harvest treatments and a corresponding increase in stand vigor. The use temporary roads would provide improved efficiencies in cost-effectively providing timber products from those units where access needs warrant their use. Subsequent road decommissioning of these temporary roads would produce beneficial long-term effects to the beneficial uses of water from reduced sediment delivery into stream channels.

Unavoidable Adverse Effects

Implementation of the proposed action alternative could cause some adverse environmental effects that cannot be effectively mitigated or avoided. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of other resources. Some adverse effects are short-term and necessary to achieve long-term beneficial effects. Many adverse effects can be reduced, mitigated or avoided by limiting the extent or duration of effects. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or lessen consequences to resource protection standards of the LRMP. The application

of project design features is intended to further limit the extent, severity, and duration of potential effects. Such measures are discussed throughout this chapter. Regardless of the use of these measures, some adverse effects may occur.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, cultural resources, or the extinction of a species. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the resource has been destroyed or removed. No irreversible commitments of resources were identified.

Irretrievable commitments apply to the loss of production, harvest or use of natural resources. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production. The only irretrievable commitment of resources relative to the project under the proposed action alternative would be the use of approximately 500 cubic yards of aggregate from existing rock sources for routine road maintenance.

Chapter 4. Consultation and Coordination

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

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Tribes

Karuk Tribe of California

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Chapter 6. List of Acronyms and Glossary

List of Acronyms

ACS – Aquatic Conservation Strategy
AMA – Adaptive Management Area
ASQ – Allowable Sale Quantity
BA – Biological Assessment
BE – Biological Evaluation
BLM – Bureau of Land Management
BMP – Best Management Practice
CEQ – Council on Environmental Quality
CFR – Code of Federal Regulations
CWD – Coarse Woody Debris
CWE – Cumulative Watershed Effects
DBH – Diameter at Breast Height
DEIS – Draft Environmental Impact Statement
EIS – Environmental Impact Statement
EPA – Environmental Protection Agency
ERA – Equivalent Roaded Acres
ESA – Endangered Species Act
FEIS – Final Environmental Impact Statement
FS – Forest Service
FSH – Forest Service Handbook
FSM – Forest Service Manual
FWS – Fish and Wildlife Service
GIS – Geographic Information System
HRV – Historic Range of Variability
HUC – Hydrologic Unit Code
LOP – Limited Operating Period
LRMP – Land and Resource Management Plan
LSR – Late-successional Reserve
MAMU – Marbled Murrelet
MBF – Thousand Board Feet
MIS – Management Indicator Species
MMBF – Million Board Feet
NEPA – National Environmental Policy Act
NFMA – National Forest Management Act
NMFS – National Marine Fisheries Service

NOA – Notice of Availability

NOI – Notice of Intent

NSO – Northern Spotted Owl

PDF – Project Design Feature

PNV – Present Net Value

RD – Ranger District

ROD – Record of Decision

ROS – Recreational Opportunity Spectrum

S&M – Survey and Manage Species

SOPA – Schedule of Proposed Actions

SQAS – Soil Quality Analysis Standards

SRNF – Six Rivers National Forest

TOC – Threshold of Concern

USDA – United States Department of Agriculture

USDI – United States Department of the Interior

VQO – Visual Quality Objectives

WA – Watershed Analysis

Glossary

Anadromous fish - Fish such as salmon, steelhead, or shad, which migrate to, mature, and spend most of their adult lives in the ocean, returning to their natal freshwater streams to spawn.

Analysis Area – project area plus lands adjacent to it which make up the land base considered by resource specialists in analyzing impacts of past, present, and reasonably foreseeable future actions in conjunction with the proposed alternatives. Analysis areas vary in size for different resource areas.

Aquatic Conservation Strategy (ACS) – a strategy designed to assist in the recovery of anadromous fish stocks at risk that is part of the Northwest Forest Plan. The ACS consists of four components that are designed to operate together to maintain and restore the productivity and resiliency of riparian and riparian-dependent ecosystems. The components include Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration.

Basal Area - the cross-sectional area of tree stems at breast height (4.5 feet), frequently described in terms of square feet per acre.

Best Management Practices (BMPs) – project-level practices used for water quality management on the National Forest System lands within the State of California; see Appendix D for those BMPs that apply to this project.

Canopy Cover and Canopy Closure – the degree to which the canopy or the branches and foliage of a tree blocks sunlight or obscure the sky. More precisely, the ground area covered by tree crowns. Canopy cover is expressed as a percent of ground area. As used in this FEIS, specific standards for canopy cover or closure apply to field measurements using a spherical densiometer.

California Wildlife Habitat Relationships – a system developed jointly by Region 5 of the Forest Service and the California Department of Fish and Game that classifies forest

stands by dominant species types, tree sizes, and tree densities and rates the resulting classes in regard to habitat value for various wildlife species or guilds.

Codominant trees - those trees with crowns forming the general level of the canopy; receiving sunlight from above and little from the side.

Cumulative Impact – the impact on the environment which results from the incremental impact of the action when added to the past, present, and foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Decommissioning – the practice of closing a road to mechanical use and returning the road to a natural or semi-natural condition. Decommissioning could include complete obliteration of the road prism (i.e. replacing fills into cuts and grading to match the natural topography) or more limited work including removing stream-crossing fills and structures (i.e. culverts) and shaping the abandoned road surface (e.g. constructing in-road water bars). In both cases, it may involve mulching the surface with woody debris and/or planting erosion-control grasses.

Diameter at Breast Height (DBH) – the diameter of a tree measured at 4.5 feet above the ground on the uphill side.

Endangered Species – plant or animal species that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of Interior in accordance with the Endangered Species Act of 1973.

Environmental Analysis – analysis of a proposed federal action and alternative actions and their predictable environmental effects, incorporating physical, biological, and socio-economic considerations.

Environmental Impact Statement (EIS) – a statement of the environmental effects of a proposed action and alternatives to it. It is required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA) and released to the public and other agencies for comment and review.

Fireline – a corridor that has been cleared of organic material to expose mineral soil. Firelines may be constructed by hand or by mechanical equipment (e.g. dozers). Hand firelines are created by forest workers using shovels and hand tools to remove organic materials and expose mineral soil. The line width generally ranges from 2 to 3 feet, depending on the fuel loading.

Hazardous fuels – A fuel complex defined by kind, arrangement, volume, condition, and location that presents a threat of ignition and resistance to control.

Hazard trees – A tree is considered hazardous if it has visible defects that may cause personal injury, death, or significant property damage. Examples of defects include detectable deformities causing loss in structural integrity, dead or dying trees, visible signs of slope instability or loss of root strength, or significant lean or large trees which could impact persons directly be either falling or rolling.

A hazard tree must possess the following characteristics: the tree is leaning toward a roadway or campground; the horizontal distance from the base of the tree to the road or campground is less than the height of the tree; and other vegetation to block a rolling log is not present. In addition, the hazard tree must meet at least one of the following criteria: 1) soil supporting the tree is showing signs of movement and slope failure is probable or, 2) the tree is dead or dying (within six months) and there is a defect either in the bole or top which poses a hazard to the public. Hazard trees in riparian reserves will

be left in place. Once the trees are down, limbs will be removed from the riparian reserve to reduce fuel loads.

Historic Range of Variability (HRV) – the historic spectrum of conditions possible in ecosystem composition, structure, and function considering temporal, spatial, and environmental factors. The LRMP assigns this parameter to vegetation by series and seral stage classes at the Forest zone scale.

Key ridges – Upper one-third slopes that are often used in suppression actions during wildfires.

Key watershed – A watershed containing: (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish; or (2) greater than six square miles with high-quality water and fish habitat.

Quadratic Mean Diameter (QMD) - the DBH of a tree having average basal area.

Issue – a point of discussion, debate, or dispute about environmental effects of the proposed action.

Landing – an area within the forest cleared of vegetation and graded level used to stockpile logs (create a log deck) and eventually to load log trucks for hauling to a mill.

Late-Successional Forest – habitat that occurs in late-successional stands that are defined as “forest seral stages which include both mature and old-growth age classes”.

Late-Successional Reserve (LSR) – one of 17 LRMP management areas (Management Area 8 – Special Habitat) that is intended to provide a core of relatively natural, undisturbed habitat for plants and animals associated with mature and old-growth forests (see LRMP IV-34).

Live Crown Ratio – proportion of a tree’s bole occupied by branches with live needles or leaves, expressed as a percentage of the tree’s total height.

Maintenance Level 1 – Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate."

Roads receiving level 1 maintenance may be of any type, class, or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for nonmotorized uses.

Maintenance Level 2 – Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high clearance vehicles.

Mainstem – the principle, largest or dominating stream or channel of any given area or drainage system.

Management Indicator Species (MIS) – species whose populations are believed to respond to management activities chosen to represent conditions of specific habitat types. They are selected by each National Forest (see LRMP IV-96).

Partial Retention – visual quality objective of providing a near-natural-appearing landscape, where management activities may be evident but must remain visually subordinate to the characteristic landscape.

Piles or Burn Piles – piling harvest or thinning residues (branches and limbs, or slash) and burning when moisture content has been reduced through evaporation, wildfire hazard is low, and atmospheric conditions are favorable for dispersal of smoke.

Planning Area – a predetermined area that encompasses a project area opportunity.

Project Area – the land base within a planning area where the connected actions associated with the project alternative take place, i.e., harvest units, haul routes, drafting sources, etc.

Project Design Features (PDFs) – parameters and requirements built into the design of a project to reduce, minimize, or eliminate impacts to various natural and human resources in order to ensure project compliance with the resource protection standards and guidelines of the LRMP. These features include Best Management Practices (BMPs).

Recommended Management Range (RMR) – a recommended range of environmental conditions that is expected to maintain ecosystem process and function; usually a subset of the historic range of variability (HRV). The LRMP assigns this parameter to vegetation by series and seral stage classes at the Forest zone scale.

Record of Decision (ROD) – a document separate from, but associated with, an environmental impact statement that: 1) states the management decision; 2) states the reason for that decision; 3) identifies all alternatives including the environmentally preferable and selected alternatives; and 4) states whether all practicable measures to avoid environmental harm from the selected alternative have been adopted, and if not, why.

Regeneration Harvest (Cutting) – a silvicultural treatment that removes nearly all trees in mature stands for the sake of establishing new stands. Regeneration harvest with legacy and shelterwood cutting are examples of even-aged regeneration harvest treatments.

Retention – visual quality objective of providing a natural-appearing landscape where management activities are not visually evident to the casual forest visitor.

Riparian Reserves – one of 17 management areas under the LRMP; established by the Forest Service to give special management considerations to protect the integrity of ecosystems bordering bodies of water and wetlands for riparian and aquatic-dependent species.

Recreation Opportunity Spectrum (ROS) – The Recreation Opportunity Spectrum (ROS) is a system for classifying and managing recreation opportunities based on the following criteria: physical setting, social setting, and managerial setting. The combination of the three criteria results in six different ROS classes, which are primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban.

Schedule of Proposed Actions (SOPA) – a notice of potential FS actions on each National Forest distributed quarterly to parties who have requested it. Contact the Forest's planning staff officer to be included on the distribution list or visit the website at: http://www.fs.fed.us/r5/sixrivers/project/ea/sopa/.

Sensitive Species – species listed as such by the Regional Forester of the FS Pacific Southwest Region because their populations are such that FS management actions could contribute to a trend toward eventual listing by FWS/NMFS as threatened or endangered species.

Seral Stage – the stage in the successional development of an ecosystem; an ecological stage, usually identified by vegetation types.

Significant Issue – a point of discussion, debate, or dispute about environmental effects that are within the scope of a proposed action; is relevant, not already decided by law, regulation,

LRMP, or other higher level decision; and is supported by scientific evidence. This issue type generally forms the basis for the development of alternatives to the proposed action.

Silviculture – the science and practice of manipulating vegetation in forest stands to meet management goals and objectives.

Site-Potential Tree – a tree that has attained the average maximum height possible given site conditions where it occurs. The measured height of a site-potential tree is used to determine tree growth potential of a site and used to define the width of Riparian Reserves under the Interim Riparian Reserve designation rules of the LRMP.

Skid Trails – off-road routes taken by tractors to access felled trees and to drag them to log landings.

Slash – residue from timber harvest or thinning; limbs, branches, and damaged small trees.

Snag – a dead standing tree.

Stand Density - the degree to which an area is occupied by trees and, hence, their intensity by which trees are competing for site resources. Through its effect on average crown size and availability of water, nutrients, and light to each tree, stand density has major implications for stand and individual tree vigor. Stand density relates to an absolute measure of tree occupancy per unit area. Relative stand density, or percentage of maximum stand density, is a measure of absolute stand density relative to the biological maximum for a given site and given species or group of species.

Stocking – a measure of stand density relative to a specific optimum that is set according to management objectives. A particular number of trees per acre at a particular size may be well stocked for one management objective but poorly stocked for another.

System Road – National Forest System roads that are considered part of the FS transportation network and are maintained to certain standards for identified purposes. Non-system roads are other existing roads that are not maintained by the FS because they are not needed for a public purpose.

Surface and Ladder Fuels – Ladder Fuels - Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease; Surface Fuels - Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

Threatened Species – plant or animal species likely to become endangered throughout all or a specific portion of tits range within the foreseeable future, as designated by the USDI Fish and Wildlife Service under the Endangered Species Act of 1973.

Visual Quality Objective (VQO) – management objective for scenic quality based on physical and sociological characteristics of an area that establishes the maximum level of future alteration to an area's landscape.

Yarding Unutilized Material (YUM) – translocation of unutilized material during logging operations from the unit to the landing for future disposal via pile burning or biomass/firewood utilization by the public.