United States Department of Agriculture

Gordon Hill Vegetation and Fuels Management Project

Forest Service

Six Rivers National Forest

August 2014

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue SW, Washington, DC 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Table of Contents

Chapter 1 – Introduction 4

Background 4
Management Direction 4
Purpose and Need for Action 5
Proposed Action 8
Decision Framework 9
Tribal Consultation 9
Public Involvement 10
Scoping 10
Opportunity to Object 11
Issues 12
Federal and State Permits, Licenses, and Certifications 12

Chapter 2 - Alternatives 1

Alternatives Considered in Detail 1
Hazardous Fuels Reduction (F-Units) 1
Commercial Thinning 6
Timber Stand Improvement 9
Jeffrey Pine-Grassland Restoration 12
Sugar Pine Restoration 13
System Road Management 13
Landings 14
20” DBH trees in LSRs 15
Proposed Action Summary 15
Project Design Features 16
Monitoring Requirements 26
Alternatives Considered but Eliminated from Detailed Study 27
Comparison of Alternatives 27

Chapter 3 - Environmental Consequences 33

Introduction 33
Cumulative Effects Analysis Assumptions 33
Effects on Elements of the Purpose and Need 34
Fire and Fuel Conditions 34
Silviculture 44
Geology 57
Soil Productivity 68
Hydrology, Water Quality, and Riparian Reserves 86
Wildlife 136
Botany 182
Port-Orford-Cedar Root Disease Risk Assessment 198

Economic Analysis 198
Roads 202
Heritage Resources 204
Environmental Justice 207

Chapter 4 - Consultation and Coordination 209

Chapter 5 – References Cited 211

Appendix A: Proposed Action Alternative Map 236
Appendix B: Wildland/Urban interface Map 248
Appendix C: Disposition of Scoping Comments 248
Appendix D: Cumulative Effects Analysis 277
Appendix E: Best Management Practices 287
Appendix F: Port-Orford-Cedar Root Disease Risk Assessment 295

Chapter 1 – Introduction

Background

The Six Rivers National Forest proposes to implement restoration actions in forested stands and reduce hazardous fuel on approximately 2,749 acres of conifer/hardwood stands including several Jeffrey and sugar pine stands through commercial thinning, timber stand improvement(precommercial thinning), and fuel reduction treatments. The project would take place on National Forest System lands administered by the Smith River National Recreation Area (NRA) in Del Norte County, California.

The proposed action, designed to be a community fire protection and wildlife habitat restoration project, falls within the category of Hazardous Fuel Reduction Projects intended to achieve the goals of Title I of the Healthy Forest Restoration Act of 2003 (HFRA). By the authority of the HFRA, the proposed action qualifies for an expedited environmental analysis process under the National Environmental Policy Act. This project meets the intent of the HFRA, by virtue of its design through a collaborative process, as described in the Del Norte Community Wildfire Protection Plan (CWPP), as a hazardous fuel reduction and ecological restoration project proposed within federally recognized Communities at Risk. It also meets the intent through additional collaboration with other interested parties. Project implementation may be accomplished through the use of stewardship contracting.

The proposed project planning area will connect two existing community protection projects: the Gordon Hill Vegetation and Fuel Management Project and the Gasquet Community Protection Project (which includes the French Hill Fuels Reduction Project). The north end of the project begins approximately one air mile south of the town of Gasquet, California, in Del Norte County. The planning area occurs in portions of the following: Township 17 North, Range 1 East, Section 25; Range 2 East, Section 25, 26, 29, 31, 32, 33, 34, 35, 36; Range 3 East, Sections 30, 31, 32; Township 16 North, Range 2 East, Section 1, 2, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36; Range 3 East, Sections 5, 7, 8, 18, 19, 30, 31; and Township 15 North, Range 2 East; Sections 1, 2, 11, 12, & 14 of the Humboldt Meridian.

Refer to the Proposed Action Map for details (Appendix A).

Management Direction

The Smith River NRA is managed under the Six Rivers National Forest Land and Resource Management Plan (LRMP). The LRMP is comprised of a set of Forest goals and objectives, and standards and guidelines for each management area.

Six Rivers LRMP Management Areas:

Management Area 7 - Smith River National Recreation Area (SRNRA): The SRNRA was established in November of 1990, by SB 2566/HB 4309. The primary goals are to

emphasize, protect, and enhance the unique biological diversity; anadromous fisheries; and the wild, scenic, and recreational potential of the Smith River while providing sustained yields of forest products.

The SRNRA is managed under direction provided by eight management areas (or zones). The Smith River NRA Act promulgates specific statutes. The Smith River NRA management plan (Appendix A of the Six Rivers LRMP) provides direction to guide compliance with those statutes.

Management Area 8 - Special Habitat (Late-Successional Reserve; LSR): The management emphasis and goal for LSR is to protect and enhance conditions of late-successional and old growth forest ecosystems which serve as habitat for late-successional and old growth related species (LRMP, IV-34, 35).

***Management Area 17 – General Forest/NRA Prescribed Timber Zone*:** The management emphasis and goal for NRA Prescribed Timber Management is to provide sustained yield of wood products while maintaining biological and ecological diversity (NRAMP, 34-35). This management area includes forested land where commercial timber management is expected to occur. Examples of allowable silvicultural activities include timber harvest, reforestation, conifer release, pre-commercial thinning, and forest pest management. The primary goals are to produce a sustained yield of timber, contribute younger seral stages to the vegetation mosaic of the forest, and conserve key components of functional habitat for mature and old growth associated species.

Management Area 9 - Riparian Reserves (RR): Riparian zones along stream courses and wet areas, and unstable areas which overlay the aforementioned broader management areas are allocated to Riparian Reserves (RRs). Under the Aquatic Conservation Strategy (ACS), RRs are used to maintain and restore riparian structures and function of intermittent streams, confer benefits to riparian-dependent and associated species, and provide for greater connectivity of the watershed (LRMP, IV-44, 45). The management emphasis for RR's is to achieve the goals of the ACS (LRMP, IV-106-108).

Other management allocation areas within the Gordon Hill Project planning area include Wild River and Recreational River under Section 2 (a) (ii) of the Wild and Scenic Rivers Act (WSRA), with corridor designations running along segments of the Hurdygurdy Creek, Gordon Creek, Coon Creek, and Craig's Creek.(NRAMP, 54-55). The management emphasis in Wild River corridors is to maintain the river segment's unique character where the appearance remains primitive, with little or no evidence of human activity (LRMP, 26, 27). In this case, timber harvesting is prohibited. In the case of Recreational River corridors, management emphasis is placed on providing for public recreational and resource uses that do not adversely impact or degrade those values. Management may occur within the corridor, provided that near natural visual quality is maintained as seen from the river corridor (LRMP, IV-60, 61). No actions are occurring in the Wild and Scenic river corridor and no timber harvest is occurring within the Recreation river corridor.

Purpose and Need for Action

Fuels

The environmental setting for the planning area is a landscape shaped by past timber management, mining activities, land exchanges, and fire. The current vegetation consists

of predominately Tanoak/Douglas-fir, Douglas-fir/redwood, Jeffrey pine grasslands, sugar, western white, lodgepole, and knobcone pine stands in a mix of seral stages distributed in a fragmented pattern across the landscape.

The project area includes the Wildland Urban Interface (WUI) for the communities of Gasquet and Big Flat. Both the Gasquet and Big Flat WUIs were designated as Communities at Risk from wildfire by the US Department of Interior in the Federal Register on August 17, 2001 (Vol. 66 No. 160, 2001). See Appendix B for WUI Project Boundary Map.

In 2003, the Gasquet Community Protection Project implemented a series of strategic fuelbreaks (six different fuelbreaks) around the community of Gasquet. In 2005, the Del Norte County Fire Safe Council completed the Community Wildfire Protection Plan (CWPP). The specific purpose of the CWPP was to identify and prioritize projects to reduce wildfire risk through the implementation of hazardous fuels reduction, community education, and pre-fire suppression in Del Norte County. The CWPP was developed using a collaborative process involving local, tribal, state, and federal government agencies, fire protection districts, land owners, and interested publics. The CWPP identified risks and mitigations to reduce risks from wildfire in Del Norte County. Nine community meetings were held throughout the County to determine what the local fire safety issues were and to prioritize projects for agency and community action.

The 2005 Del Norte Fire Safe Council CWPP identified potential treatment needs around the communities of Big Flat and Gasquet. In addition, the CWPP recommended designated fuelbreak areas along major travel routes recognized as important evacuation routes in the event of wildfires. The Gordon Hill Project will connect and enhance the two previously completed community protection projects by treating fuels along a main travel route between these communities, protecting an important evacuation route, and providing a break in the continuity of fuels. The strategic fuelbreaks and other treatment areas are intended to reduce hazardous fuel loading to retard the spread of fire and provide fire suppression personnel a higher probability of successfully attacking a wildfire.

The CWPP states that a first priority for defensibility of these communities at risk is to create strategically located fuelbreaks utilizing road systems and ridge tops around the communities. In response to the findings in the CWPP, the Smith River NRA has implemented the following actions: 2008 Big Flat Vegetation and Fuels Management Project, 2009 Elk Camp Ridge Fuelbreak (Gasquet area), 2009 Hiouchi Fuelbreak Project, the 2009 Coon Mountain Project (Rock Creek area), 2009 Gasquet Community Protection Project maintenance fuel reduction, and Station 3 Fuelbreak Project (Hiouchi, Low Divide area). In addition the Smith River NRA is continuing to collaborate with the Del Norte Fire Safe Council and Cal Fire to complete work on private property adjacent to the Forest Service projects to strengthen the effectiveness of the fuels reduction projects.

Historic fire information shows that there have been a significant number of fires in the past along high use roads, that were primarily human-caused. Most fires on the District have burned in the same pattern as shown from historical fire records. Due to the prevailing winds in this area, fires have a tendency to spread up canyon and upslope toward the ridge top. The overall objectives for fuel treatments are to provide defensible space, strategic control lines, and safe access for firefighters, as well as to lessen damage to communities and adjacent suitable habitat from severe, unplanned, and unwanted wildfires. The strategic

fuelbreaks and other treatment areas are intended to reduce hazardous fuel loading to retard the spread of fire and to provide fire suppression personnel a higher probability of successfully attacking a wildfire.

Vegetation and fuels management activities are designed to reduce the amount of fuels around the communities and provide additional defensible space and strategic control lines for firefighters to assist with the control efforts in the event of a wildland fire threatening the community and surrounding developed areas.

Restoration

Approximately half of the project occurs in a Late-Successional Reserve (LSR), specifically LSR 303. The Smith River National Recreation Area Late-successional Reserve Assessment (LSRA; USDA 1995) determined the following: 1) the LSR is deficient in late-successional habitat; 2) stands that had been converted to early seral vegetation due to past logging and wildfires can be treated to develop late-successional habitat; and 3) strategic fuelbreaks are needed to protect late-successional habitat and reduce catastrophic loss due to wildfire. Extensive stands of dense plantations exist that not only create a fuels hazard, they also do not provide suitable habitat for late-successional species such as the northern spotted owl (NSO) or marbled murrelt (MAMU). Plantations and young natural stands are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. Young stands have the potential to achieve rapid diameter and height growth with thinning treatments. Silvicultural prescriptions can be applied to younger stands in order to accelerate their development toward late seral conditions. These treatments could increase the amount of late seral vegetation sooner than would occur naturally. The LSRA indicated the proposed area needs extensive fuels treatments to protect the LSR as well as extensive habitat restoration.

On June 28, 2011, the FWS released the *Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina).* The purpose of recovery plans is to describe reasonable actions and criteria that are considered necessary to recover a listed species. The Recovery Plan recommends increased conservation and restoration of spotted owl sites and high-value spotted owl habitat. Recovery Action 6 states:

> "In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery."

The 2011 NSO RP recognizes the importance of maintaining, and restoring, habitat for the recovery and long-term survival of the spotted owl. "Long-term spotted owl recovery could benefit from forest management where the basic goals are to restore or maintain ecological processes and resilience. Therefore, we recommend application of disturbance-based principles to such decisions (Franklin et al. 2002, 2006, 2007, Drever et al. 2006, Noon and Blakesley 2006, Carey 2007, Long 2009, Swanson et al. 2010)." The 2011 RP relies on Federal lands to provide the major contribution for recovery (USDI Fish and Wildlife Service 2011).

On December 4, 2012 the Final 2012 Northern Spotted Owl Critical Habitat rule was published. Critical habitat consists of those areas which have physical or biological features essential to the conservation of the species. The 2012 Northern Spotted Owl Revised Critical Habitat Rule states "we encourage land managers to consider

implementation of forest management practices recommended in the Revised Recovery Plan to restore natural ecological processes where they have been disrupted or suppressed (e.g., natural fire regimes), and application of ecological forestry management practices ….”.

The Smith River is identified as a Tier 1 key Watershed under the Aquatic Conservation Strategy (ACS) in the Six Rivers National Forest Land and Resources Management Plan (LRMP). Tier 1 watersheds contribute directly to conservation of at-risk salmonids and resident fish species. They also have a high potential for being restored as part of the watershed restoration program and are the highest priority for restoration. The ACS identifies that one of the most important components of watershed restoration is “restoration of the conditions of riparian vegetation”. The Strategy states that restoration activities restore watershed processes “to recover degraded habitat” and that “silvicultural treatments may be used to restore large conifers in Riparian Reserves”.

Fuelbreaks would reduce the wildfire impacts on existing late-successional habitat both by reducing the impacts of roadside ignitions and by breaking up larger blocks of fuel.

Given the environmental conditions of the project area and the information and recommendations from the above documents, the **Purpose and Need** for the proposed action is to:

- Reduce hazardous fuel loading in strategically located high-risk areas to enhance the defensibility between the communities of Big Flat and Gasquet, and to protect existing late-successional habitat within the LSR.
- Accelerate development of late-successional habitat characteristics in plantations and young natural stands, and restore ecological conditions in special habitats (LSRs, Riparian Reserves, sugar pine stands and Jeffrey pine grasslands). The proposed action will meet the objectives of the Smith River NRA LSRA, the 2011 Recovery Plan for the Northern Spotted Owl, the 2012 Northern Spotted Owl Critical habitat rule, and the Aquatic Conservation Strategy.
- Provide biomass utilization and forest commodities in the form of timber, post and pole, fuelwood/fire wood or wood chips.

The Purpose and Need objectives drove the identification of treatment areas for the strategically placed fuelbreaks within the WUI and young even-aged stands (natural stands and plantations) that would benefit from treatment.

Proposed Action

The Six Rivers National Forest proposes to manage vegetation and hazardous fuels on approximately **2,749** acres of conifer/hardwood stands, Jeffrey Pine meadow, and sugar pine (Table 1). Treatments include commercial timber harvesting, timber stand improvement, and fuel reduction treatments. Actions included in this proposal are as follows:

- 1168 acres of fuel reduction treatments employing manual, mechanical and prescribed burning methods in conifer stands in various seral stages within strategic fuelbreak areas.

- 665 acres of Commercial Thinning (CT) to a minimum 40% crown closure and activity fuel treatment in 40 to 45-year old plantations and young natural stands within and outside of fuelbreak areas. Of these acres, 521 acres would be ground skidded and 144 acres would be cable yarded.
- Approximately 2 to 3 landings/disposal sites per unit have been identified for use. Thirty-eight existing landings/natural openings and wide spots in roads would be utilized and 9 new landings would be used.
- 1.08 miles of road reconstruction on Operational Maintenance Level (OML) 1 roads (temporary upgrade to OML 2) and subsequent re-closure after project implementation.
- 0.26 miles of new temporary road construction.
- 2.8 miles of existing (non-system) temporary roads would be utilized with minor reconstruction.
- 801 acres of Timber Stand Improvement (TSI), including 6 acres of hardwood restoration, which includes 372 acres of 20 to 30 year old plantations and natural stands and 429 acres of less than 30-years old plantations and natural stands. All stands would be thinned to a minimum 40% crown closure with approximately 15 to 24 foot spacing.
- Approximately 31 miles of roadside/ridge top fuelbreak will be created. Once treatments and activity-generated fuels are fully completed in commercial and TSI units an additional 4 miles of roadside/ridge top treatments will be considered as part of the fuel break corridor system.
- 95 acres of fuels reduction/prescribed burning in a Jeffrey pine grassland restoration.
- 20 acres of sugar pine restoration

Chapter 2 of this EA has a complete description of the Proposed Action, including specific project design features and monitoring requirements.

Decision Framework

The Forest Supervisor of the Six Rivers National Forest will decide whether and how to fulfill the purpose and need of the Gordon Hill Vegetation and Fuels Management project in accordance with Forest Plan goals, objectives and desired future conditions. The responsible official will decide whether to implement the proposed action, a modified action alternative, or the no action alternative.

Tribal Consultation

The Six Rivers National Forest initiated formal governmental consultation with three Native American tribes on February 19, 2013 regarding the preliminary design of the Gordon Hill Vegetation and Fuels Management Project. The tribes contacted were the Tolowa Nation, the Smith River Rancheria, and the Elk Valley Rancheria. No issues or

concerns about the project were raised.

Public Involvement

Collaboration

Collaboration was initiated by the Del Norte Fire Safe Council who volunteered for the task of coordinating the local effort with various stakeholders to develop a fire safe plan. The Council received a grant from the US Forest Service Economic Action program in 2003 to fund the creation of the fire safe plan. The first phase of collaboration culminated in the completion of the Del Norte Fire Safe Plan and CWPP in September of 2005, which identified areas of concern and potential project opportunities across multiple land ownerships within Del Norte County.

Upon the completion of the CWPP, the Six Rivers National Forest identified National Forest System lands near its communities as community protection project opportunities.

Early project information gathering field trips were held with interested parties from environmental groups and industry in May of 2012. Information from the collaborative effort was used to help develop the proposed action.

A synopsis of a preliminary proposed action was prepared and sent to prospective stakeholders to initiate the collaboration process required under the Healthy Forest Restoration Act (HFRA) for this project. The feedback received from eight individuals and groups was primarily in the form of questions and project design recommendations.

As a result of the feedback received from the initial outreach effort, an informational public meeting/field trip was scheduled on June 26, 2013. This event was announced through invitation letters mailed to prospective stakeholders. None of the participants attended the event, but three groups asked for other field trip dates and each was accommodated by the Forest Service. Field trips were held on August 27, 2013 and April 22 and July 23, 2014.

Concerns raised included the economic viability of project design, environmental effects to various resource values, and road access by the public. Ideas and concerns raised by the participants were considered by the Forest and led to the finalization of the proposed action.

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 significant 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. To date, the public has been invited to participate in the environmental analysis of this project in the following ways:

- The Gordon Hill Vegetation and Fuels Management project has been listed on the Six Rivers National Forest Schedule of Proposed Actions (SOPA) since March of 2010.

- On March 15, 2013, a scoping package providing information and seeking public comment on the proposed action was mailed to approximately 48 individuals and groups. This included federal and state agencies, Native American groups, local government officials, businesses, interest groups, adjacent landowners, and other individuals.
- Field trip opportunities were made available (see above dates).

A total of eight responses to this mailing were received, with four parties that provided substantive comments, one state agency that provided procedural recommendations, two individuals that expressed support for the project, and one individual that requested a copy of this EA. Agency responses and dispositions to the comments received can be found in Appendix C of this EA.

Opportunity to Object

This environmental assessment, along with the draft decision notice and finding of no significant impact is subject to objection pursuant to 36 CFR 218, Subparts A and C. Objections will only be accepted from those who submitted project-specific written comments during scoping or other designated comment period. Issues raised in objections must be based on previously submitted comments unless based on new information arising after the designated comment period.

Objections must be submitted within 30 days following the publication of the legal notice in the Del Norte Triplicate. The date of the legal notice is the exclusive means for calculating the time to file an objection. Those wishing to object should not rely upon dates or timeframes provided by any other source. It is the objector's responsibility to ensure evidence of timely receipt (36 CFR 218.9).

Objections must be submitted to the reviewing officer: Randy Moore, Regional Forester, USDA Forest Service; Attn: Gordon Hill; 1323 Club Drive, Vallejo, CA 94592. Ph. (707) 562-8737. Objections may be submitted via mail, FAX (707-562-9229), or delivered during business hours (M-F 8:00am to 4:00pm). Electronic objections, in common (.doc, .pdf, .rtf, .txt) formats, may be submitted to: objections-pacificsouthwest-regional-office@fs.fed.us with the Subject: Gordon Hill.

Objections must include (36 CFR 218.8(d)): 1) name, address and telephone; 2) signature or other verification of authorship; 3) identify a single lead objector when applicable; 4) project name, Responsible Official name and title, and name of affected National Forest(s) and/or Ranger District(s); 5) reasons for, and suggested remedies to resolve, your objections; and, 6) description of the connection between your objections and your prior comments. Documents may be incorporated by reference only as provided for at 36 CFR 218.8(b).

For additional information, contact District Ranger David Palmer, at the Smith River National Recreation Area (707) 457-3860 or project team leaders Brenda Devlin (707) 457-3862 or Sheila Balent (707)457-3968.

Issues

Scoping and public involvement activities are used to identify unresolved issues about the effects of the proposed action. Issues are addressed through the incorporation of project design features associated with the proposed action, and potentially the development of alternatives to the proposed action. Additional issues and concerns considered but determined non-significant or outside the scope of this project are discussed in Appendix C of this EA.

A comment was received identifying the project's potential impacts on Pacific fisher populations, connectivity and habitat as a significant issue. Except for 12 acres of moderate quality denning habitat that will occur within the fuelbreak (where treatment is limited to within 50ft from a high use road), the stands to be commercially and precommercially thinned are young, even-aged stands that are densely stocked. These stands do not contain the necessary habitat characteristics for the fisher for denning. In addition, no treatment areas have been established for all Riparian Reserves (RR). Camera stations have been deployed in the project area within and adjacent to proposed units, with three detections. Although the treatment areas themselves do not occur in suitable denning habitat and there are no known den sites, a limited operating period has been imposed for any treatment within 0.25 miles of suitable fisher denning habitat near the detection sites. The project will maintain current fisher habitat, will accelerate the development of fisher habitat in young currently unsuitable stands, and will not cause disturbance to fishers during the breeding season. The project will not adversely impact the fisher; therefore, this does not represent a significant issue for the project.

There were no significant issues identified, as defined in 40 CFR 1502.2. As a result, no other action alternatives were developed for evaluation in this EA.

Federal and State Permits, Licenses, and Certifications

On June 10, 2010, the North Coast Regional Water Quality Control Board adopted Waiver No. R1-2010-0059, Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on national Forest System Lands in the North Coast Region (the Federal Waiver). This waiver exempts certain activities (must meet all conditions of the Waiver) conducted on National Forest System Lands from the waste discharge requirements of Article 4 (commencing with Section 13260) of Chapter 4, Division 7 of the California Water Code, except as provided within the waiver. Order No.R1-2010-0029 expires on June 10, 2015, unless renewed by the Regional Water Board.

Chapter 2 - Alternatives

This chapter describes and compares the alternatives considered by the Forest Service for the Gordon Hill Vegetation and Fuels Management Project. It includes a description of alternatives considered in detail, along with an overview of project design features and monitoring requirements. A map of the Proposed Action alternative can be found in Appendix A of this EA. This chapter ends with a comparison of the alternatives by attributes and connected actions, as well as relative to how well they fulfill the purpose and need objectives for the project and estimated effects to environmental components that warrant mandatory disclosure, which are further described in Chapter 3.

Alternatives Considered in Detail

Alternatives considered in detail include the No Action (Alternative 1) and the Proposed Action (Alternative 2) alternatives.

Alternative 1 (No Action)

The emphasis of this alternative is to propose no vegetation and fuels reduction treatments in the Gordon Hill project area at this time. This alternative represents the existing and projected future condition against which the proposed action is compared.

Alternative 2 (Proposed Action)

The proposed action was designed to meet the project's purpose and need while meeting the standards and guidelines of the LRMP, and other laws and regulations. Suggestions received from the public during the informational meeting and field trip were also considered and incorporated in the final design of the proposed action.

Hazardous Fuels Reduction (F-Units)

Fuels treatment units would occur in **82** high-risk roadside and ridge top units that encompass approximately **1,168** acres in 4 different corridors. Unlike the other proposed treatment categories, these treatments would occur in a wide variety of vegetation types and seral stages (shrub through late-successional).

The proposed action would create strategically located fuelbreaks along high use roads and ridgetops. These fuelbreaks would reduce fuel loadings in order to create a defensible space for fire suppression resources, decrease the potential for detrimental wildfire effects to the overall project area between the communities of Big Flat and Gasquet, and within the Rock Creek community WUI, and enhance the treated stands resiliency to fire.

Fuelbreaks would be built on ridgetops to approximately 150 feet in width on each side of the road or to the nearest ridgetop (or other various combinations), which result in approximately 300 feet along . The fuelbreaks are located along the following road systems

and labeled as corridor A, B, C, and D: County Road 405 and 411(Corridor A); Forest Road 17N07 and 16N19 (Corridor B); Forest Road 17N07 (Corridor C); and Forest Road 16N19E (Corridor D). These fuelbreak corridors will be created by reducing shrubs, small trees less than 8" DBH, and ground fuels. Methods of treatment include handpiling and burning, understory burning with handline construction, or chipping of materials (see more specific treatments for pine dominated units below).

Biomass utilization of small diameter material and fuels generated by all treatments should be considered as the first option for activity-generated fuels treatment within the project area. Utilization of this material provides products for several industries. Some small diameter trees may also be suitable for use as posts and poles and/or public firewood.

Construction of these fuelbreaks would remove ladder fuels and heavy concentrations of brush to break up the continuity of the fuel loading, through the development of a fuelbreak by raising the canopy base height of existing trees. The project includes cutting moderate to heavy brush, seedlings, saplings, and small diameter trees up to 8" diameter at breast height (DBH), and limbing lower tree branches of overstory trees to remove fuel "ladders" (continuous fuels from the ground up to the overstory canopy). Snags within the proposed burn area will not be felled unless they propose a safety hazard or pose a risk to control efforts. Any snag felled in the burn area would be retained as downed logs. No treatments will occur within 50 ft. of stream channels within Riparian Reserves (RR). In sensitive botanical areas, debris will be cut and then removed to non-sensitive area for burning and/or fire wood gathering. All overstory trees will be retained. This project will create fuelbreaks that would average 300 feet wide (or to the nearest ridgetop) along existing FS and County roads. Actual widths may vary based on environmental features such as topography and vegetation distribution. Once the initial treatment has been completed, maintenance burns or treatments would be implemented every 5-15 years or as need is determined.

Fuelbreak construction will not occur in the Wild and Scenic River corridor or within the no-treatment buffer in Riparian Reserves. In fuelbreak areas where treatments need to occur in high quality northern spotted owl (NSO) nesting habitat in order to maintain the effectiveness of the fuelbreak, fuel concentrations will be only reduced within 50 ft. of main roads. In mid mature stands that contain high quality NSO foraging habitat would treat the first 50 feet (roadside) and, if it occurs, the 50 feet nearest the ridge top following the standard fuelbreak prescription described above. In areas remaining, 40 to 50% of existing brush would be maintained for wildlife cover. Overstocked trees less than 8" DBH will still be reduced and pruning of residual trees will still be allowed in these areas.

Pine Dominated Fuels Treatment Units

Blended throughout the project area are Jeffrey pine grasslands occupying the ridges along with mixed fire-adapted lodgepole, knobcone, and western white pine stands. Sugar pine is present, but sparse throughout the project area.

Camp Six Communication Site (F-47 A) and access road 17N71: This site is a high value communications link for the Del Norte County area and the treatment is intended to reduce the high fire risk and support defensible space of the site. Communications equipment on this site is used for Emergency responses services (California Highway Patrol, Del Norte Sheriff's Dept., Del Norte Ambulance, and Gasquet Fire Dept.) for the

Gasquet, Hiouchi, Rock Creek, and Big Flat areas, as well as along the Highway 199 corridor. This site is the location of two weather stations (US Forest Service and National Oceanic Atmospheric Administration) and also collects and analyzes all seismic activity for the Del Norte County area. In addition, US Cellular also maintains a cell tower at this location.

Approximately 248 acres of the fuelbreak occurs in predominantly pine stands. This area includes fuels treatment units F-13A to F-19A, Camp Six Communications Site F-47A, and F-1B to F-3B for a total of 11 units within the roadside fuelbreak. These areas consist of small diameter, densely-stocked stands similar in condition to young plantations. Treatment will consist of reducing brush/trees and thinning to a spacing of 10 to 20 feet by hand methods. After being thinned, pile burning and/or fire wood gathering would be conducted. In sensitive botanical areas, debris will be cut and then removed to non-sensitive area for burning and/or fire wood gathering. Treatment within the fuels corridor would be conducted approximately 150 ft. off each side of the road and would include 150 feet around the Camp Six Communication Site.

Fuelbreaks/Activity Fuels Treatments

In addition to fuels treatment units, commercial harvest and timber stand improvement (TSI) units would be considered part of these ridge top/main road system fuelbreaks (once treatments and activity-generated fuels are fully treated). Approximately 234 acres of the 801 acres of TSI and approximately 150 acres of the 665 acres of commercial thinning are within the fuelbreak corridor. Activity-generated material treatments include manual, mechanical, and prescribed burning methods (ie. understory or hand or machine pile burning).

The following describes and summarizes the categories of proposed vegetation and fuels management activities and connected actions associated with the project.

- Cutting understory vegetation (HC): Hand cutting moderate to heavy brush, seedlings, saplings, and small diameter trees up to 8" DBH, and limbing lower tree branches of overstory trees (generally up to 6-10 feet above the ground) to remove fuel "ladders" (continuous fuels from the ground up to the overstory canopy) that could accelerate fire spread and increase resistance to control. Work would be accomplished with chainsaws

- Hand pile and burn (HPB): Existing ground fuels, thinning and pruning residue, and cut brush would be piled by hand and burned.

- Chipping: Existing ground fuels, thinning and pruning residue, and cut brush would be pulled to the road and chipped into small pieces using a chipper. Chipping residue would be distributed back into the treatment unit or utilized for biomass.

- Mastication (MAS): Low ground-pressure mechanical equipment (similar to a mowing machine) used to cut live vegetation. Material would be masticated up to approximately 6-8 inches above the ground surface.

- Understory burn with hand line construction (UB/HLC): Understory burning is the use of low-intensity fire to further reduce ground and surface fuels. Hand-

constructed control lines (up to 18" wide, cleared down to mineral soil) are used to limit the spread of the prescribed fire.

- Understory burn with wet line construction (UB/WL): Understory burning is the use of low-intensity fire to further reduce ground and surface fuels. In lieu of hand-constructed control lines, wet line will be used to limit the spread of the prescribed.
- Fuelwood and biomass utilization (FWB): Providing opportunities for the public to collect cut vegetation to use for fuelwood or for biomass utilization.
- Lop and Scatter (L&S): Cutting activity fuel into length and scattering evenly throughout unit.
- Yarding Tops (YT): Yarding tops refers to pulling the tops of the trees (when the top is attached to the last log) and piling it at landings, the tops of yarding corridors, or at disposal areas for future treatments of biomass utilization, firewood gathering or burning. These treatments would reduce potential surface fuels.
- Whole Tree Yard (WTY): refers to yarding trees with boles, limbs, and tops attached, similar to YT.

Fuels maintenance will be performed on treatment areas as needed every 5 to 15 years or as funding allows and as need is identified. The areas may be retreated by also utilizing a combination of treatments described above. Understory burning will be prescribed in many cases to help maintain and sustain the desired fuel loading in these units. Site-specific review by a fuels specialist will be conducted prior to understory burning to ensure that a low intensity underburn can be achieved.

Where fuelbreak corridors overlap other project units (commercial or TSI), additional fuel treatments may be necessary after initial activities to assist in reducing high fire danger and enhance the integrity of the fuelbreak.

Table 1 summarizes the proposed action by treatment type and acres treated. As stated above, the fuelbreaks occur in a variety of vegetation types. Portions of the fuelbreak occurs in pine series, which does not have the potential to become suitable habitat for the NSO or MAMU; therefore seral stage descriptions below do not indicate potential habitat as it would in other conifers types.

Table 1. Fuel Reduction Treatment Unit Summary

Unit ID	Stand Type/ Seral Stage	Est. Acres	Fuels treatment	LSR*/ NSO CHU	Corridor
F-01 (A)	EM	13	HPB/UB		A
F-02 (A)	EM	3	HPB/UB		A
F-03 (A)	EM /MM	7	HPB		A
F-04 (A)	EM /MM	15	HPB		A
F-05 (A)	EM /PH	9	HPB		A
F-06 (A)	MM	8	HPB		A
F-07 (A)	MM/LM	10	HPB		A

F-08 (A)	EM	4	HPB		A
F-10 (A)	EM/PH	4	HPB		A
F-11 (A)	EM/PH	20	HPB		A
F-12 (A)	EM	61	HPB		A
F-13 (A)	EM	17	HPB		A
F-14 (A)	EM	13	HPB		A
F-15 (A)	EM	30	HPB		A
F-16 (A)	EM	15	HPB		A
F-17 (A)	EM	6	HPB		A
F-18 (A)	EM	13	HPB		A
F-19 (A)	EM	7	HPB		A
F-20 (A)	EM/PH	5	HPB		A
F-21 (A)	EM/PH	5	HPB		A
F-22 (A)	EM/PH	54	HPB		A
F-23 (A)	EM/PH	6	HPB		A
F-24 (A)	EM/PH	5	HPB		A
F-25 (A)	EM/PH	3	HPB		A
F-26 (A)	EM/PH	7	HPB		A
F-27 (A)	EM /MM	32	HPB		A
F-28 (A)	EM /MM	6	HPB		A
F-29 (A)	EM /MM	11	HPB/UB	LSR	A
F-30 (A)	EM /MM	13	HPB/UB	LSR	A
F-31 (A)	EM /MM	15	HPB/UB	LSR	A
F-32 (A)	EM	26	HPB/UB	LSR/CHU	A
F-33 (A)	EM	15	HPB/UB	LSR/CHU	A
F-34 (A)	EM	5	HPB/UB	CHU	A
F-35 (A)	EM/MM	3	HPB/UB	CHU	A
F-36 (A)	EM/MM	22	HPB/UB	LSR	A
F-37 (A)	EM/MM	6	HPB/UB	LSR/CHU	A
F-38 (A)	EM/MM	9	HPB/UB	LSR/CHU	A
F-39 (A)	EM/MM	22	HPB	LSR/CHU	A
F-40 (A)	MM	11	HPB	LSR/CHU	A
F-41 (A)	MM	13	HPB	LSR/CHU	A
F-42 (A)	MM	5	HPB	LSR/CHU	A
F-43 (A)	MM	13	HPB	LSR/CHU	A
F-44 (A)	MM	8	HPB	LSR/CHU	A
F-45 (A)	MM	12	HPB	LSR/CHU	A
F-46 (A)	LM	12	HPB	LSR/CHU	A
F-47 (A)	MM	8	HPB	LSR	A
F-01 (B)	EM /MM	28	HPB		B
F-02 (B)	EM /MM	6	HPB		B
F-03 (B)	EM /MM	105	HPB		B

F-04 (B)	EM	69	HPB		B
F-05 (B)	EM	14	HPB/UB		B
F-06 (B)	EM	7	HPB/UB	CHU	B
F-07 (B)	EM	7	HPB	CHU	B
F-08 (B)	EM	5	HPB/UB	CHU	B
F-09 (B)	EM	2	HPB/UB	CHU	B
F-10 (B)	EM	9	HPB/UB	CHU	B
F-11 (B)	EM	11	HPB/UB	CHU	B
F-12 (B)	EM	6	HPB/UB	CHU	B
F-13 (B)	EM	6	HPB/UB	CHU	B
F-14 (B)	EM	28	HPB/UB	CHU	B
F-15 (B)	EM	1	HPB/UB	CHU	B
F-16 (B)	EM	9	HPB/UB	CHU	B
F-17 (B)	EM	12	HPB/UB	CHU	B
F-18 (B)	EM	19	HPB/UB	CHU	B
F-19 (B)	EM	19	HPB/UB	CHU	B
F-20 (B)	EM	29	HPB/UB	LSR	B
F-21 (B)	EM	17	HPB/UB	LSR	B
F-22 (B)	EM	5	HPB/UB	LSR	B
F-23 (B)	EM	7	HPB/UB	LSR	B
F-24 (B)	EM	7	HPB/UB	LSR	B
F-25 (B)	EM	19	HPB/UB	LSR	B
F-26 (B)	EM	7	HPB/UB	LSR	B
F-27 (B)	EM	9	HPB/UB	LSR	B
F-28 (B)	EM	1	HPB/UB	LSR	B
F-29 (B)	EM	27	HPB/UB	LSR	B
F-30 (B)	EM	9	HPB/UB	LSR	B
F-31 (B)	EM	2	HPB/UB	LSR	B
F-32 (B)	EM	5	HPB/UB	LSR	B
F-01 (C)	EM	26	HPB/UB		C
F-02 (C)	EM	8	HPB/UB		C
F-01 (D)	EM	11	HPB/UB	LSR	D
F-02 (D)	EM	9	HPB/UB	LSR	D

Note: PH= pole harvest, EM= early mature; MM= mid mature; LM= late mature; HPB = hand pile and burn; UB=understory burning; LSR = Late Successional Reserve Note: *LSR boundary coincides with marbled murrelet Critical Habitat boundary; NSO CHU= NSO Critical Habitat.

Commercial Thinning

Commercial thinning would occur in **41** units on a total of **665** acres (Table 2). The treatments would occur in even-aged, young stands (40 to 80 years of age) that are

primarily plantations and young, natural stands in early seral stages of development. Units receiving this treatment occur both within and outside of designated fuelbreak corridors.

Treatments would consist of variable density thinning. The general prescription would be commercial thinning from below down to between 40 and 60% or greater canopy cover, although this would be highly variable. Variable basal area retention would be used to create gaps to promote horizontal diversity through the development of understory trees, while in other areas clumps of trees would be maintained to promote the development of snags. Individual trees with high potential for rapid growth would be widely spaced to accelerate diameter and height growth with the expectation of achieving vertical diversity. These trees are also expected to develop wide crowns and large limbs. No predominant trees would be removed. Existing snags (20" DBH or greater) and downed logs (20" diameter or greater and 10 feet long) would be maintained unless they pose a safety hazard or reduce the effectiveness of the fuelbreak.

The focus of this treatment is to retain the largest trees with the best crowns. These trees are generally at or above the average canopy and have the best opportunity to take advantage of additional light, water, and nutrients to maintain or increase growth. The treatments are designed to maintain the existing native species diversity (including hardwoods) in the unit being treated. No predominant trees would be cut, and the largest trees would be favored for retention. No trees over 20" DBH would be removed from proposed units within the LSR area to meet LRMP standards and guidelines for LSR. Prescribed logging methods based on existing road infrastructure and past logging entries (old logging roads and skid trails) include ground based tractor skidding and mechanized harvesters on gentle slopes (<35% slope) and cable yarding and tractor with 100-foot end lining capability on steeper ground (>35% slope).

Approximately **2.8 miles** of existing temporary roads and **38 existing landings/natural openings** would be utilized with minor reconstruction and vegetation removal in some of the proposed units. Approximately **0.26 miles** of new temporary road construction and **9 new landings (approximately 0.25 acre in size)** will be needed in order to implement activity treatments. Both the existing temporary roads and new temporary roads would be subsequently decommissioned. Any fuels generated through road construction or maintenance will be chipped or hand piled and burned on site.

Treatments in these stands using commercial harvest methods would produce merchantable material. There is the potential for commercial harvesting to yield about **4 MMBF** (million board feet) of timber from the proposed units.

<u>Commercial Activity Fuel Treatments</u>

Post-harvest activity fuel treatments would include one or more actions (Table 2) depending on fuel loading post-harvest. Wherever possible, larger slash material will be made available for public firewood gathering. Activity-generated ground and surface fuels may be machine piled on landings by ground-based equipment and burned. Post treatment handpile and burning may occur depending on fuel loading post-harvest.

The proposed action offers opportunities to provide biomass utilization and forest commodities in the form of timber, post and pole, fuelwood/fire wood or wood chips commercial thinning treatment areas. All activity fuel treatments and fuelbreak areas will generate materials that could also be utilized as biomass.

Understory burning will be prescribed in many cases to help maintain and sustain the desired fuel loading in these units. Site-specific review by a fuels specialist will be conducted prior to understory burning to ensure that a low intensity underburn can be achieved.

The following table summarizes the proposed commercial harvest activities by unit.

Table 2. Commercial Harvest Unit Summary

Unit ID	Stand Type/ Seral Stage	Acres	Logging System	Activity Fuels treatment	Occurs in LSR*/ NSO CHU
1	EM	19	Ground	WTY/HPB/UB	LSR
2	PH/EM	58	Ground	WTY/HPB/UB	LSR
3	EM	42	Ground	WTY/HPB/UB	LSR
4a	EM	80	Ground	WTY/HPB/UB	
9	PH/EM	44	Ground	WTY/HPB	LSR
10	PH	85	Cable	WTY/HPB	LSR/CHU (approx. 40 ac)
11a	PH	6	Ground	WTY/HPB	LSR
11b	PH	8	Cable	WTY/HPB	LSR
15a	EA	17	Ground	WTY/HPB/UB	LSR
15b	EA	8	Cable	WTY/HPB/UB	LSR
17	EM/MM	15	Ground	WTY/HPB/UB	LSR
22a	PH	4	Ground	WTY/HPB	LSR
22b	PH	2	Cable	WTY/HPB	LSR
23	PH	13	Ground	WTY/HPB/UB	
24b	EM	5	Ground	WTY/HPB/UB	
24c	EM	11	Ground	WTY/HPB/UB	
26	PH	9	Ground	WTY/HPB	
30	EM	12	Ground	WTY/HPB	
31	EM	12	Ground	WTY/HPB	
37	EM	4	Ground	WTY/HPB/UB	LSR
44a	EM	13	Ground	WTY/HPB	LSR/CHU
45	PH/EM	16	Cable	WTY/HPB/UB	LSR/CHU

47a	EM	15	Ground	WTY/HPB/UB	CHU
47b	EM	6	Cable	WTY/HPB/UB	CHU
47C	EM	9	Ground	WTY/HPB/UB	CHU
52	EM	4	Cable	WTY/HPB/UB	
55	EM	10	Ground	WTY/HPB	LSR/CHU
57a	PH	4	Ground	WTY/HPB/UB	
58	EM/MM	3	Cable	WTY/HPB	
82	EM	8	Ground	WTY/HPB	
84	PH/EM	22	Ground	WTY/HPB	
86	EM	14	Ground	WTY/HPB/UB	LSR
86B	PH/EM	4	Cable	WTY/HPB/UB	LSR
88	EM/MM	4	Ground	WTY/HPB/UB	
89	PH	8	Cable	WTY/HPB	LSR/CHU
91	PH	28	Ground	WTY/HPB/UB	LSR
92	PH	4	Ground	WTY/HPB/UB	LSR
93	PH	6	Ground	WTY/HPB/UB	LSR/CHU
207	PH	10	Ground	WTY/HPB	
241	PH	8	Ground	WTY/HPB	LSR/CHU
243	PH	15	Ground	WTY/HPB	LSR

PH= pole harvest, EM= early mature, EA= early mature with predominates; MM= mid mature; WTY = whole tree yarding; HPB = hand pile and burn; UB=understory burning; LSR = Late Successional Reserve (Note: *LSR boundary coincides with marbled murrelet Critical Habitat boundary); CHU= NSO Critical Habitat; F = foraging habitat; LQ = low quality; D=dispersal only habitat (NSO CHU only)

Timber Stand Improvement

This treatment would involve non-commercial thinning and removal of small diameter trees in dense, young plantations and young, natural conifer-hardwood stands on approximately **801** acres in **42** units. In areas of smaller diameter trees, spacing would be 15 to 24 feet or generally to 40% canopy closure. Hardwoods would comprise a portion of the residual stand, with consideration given to clump thinning and selection of the best stems to leave. Culturing of sugar pine would occur wherever healthy trees are found. In hardwood-dominated stands, thinning would favor conifers and remove mostly 3-9 inch DBH tanoak and chinquapin to improve stand structure, species composition, resiliency

to disturbance, and growth. Units receiving TSI treatment occur both within and outside of designated fuelbreaks.

The focus of the TSI thinning treatment is to retain the largest trees with the best crowns. These trees are generally at or above the average canopy and have the best opportunity to take advantage of additional light, water, and nutrients to maintain or increase growth. The treatments are designed to maintain the existing native species diversity, including hardwoods.

Hardwood Restoration

One TSI stand (Unit 246, 6 acres) is designed for hardwood restoration. This stand is primarily composed of tanoak, with some chinquapin and scattered Douglas-fir. Even though this stand is predominately hardwoods, treatment will be similar to TSI treatment described above, and the largest trees will be retained with the best crowns. Priority will be in leaving single stemmed hardwoods first, followed by thinning hardwood clump sprouts to 30 to 50% of the residual stems basal area. This will improve growth to the remaining trees while limiting the light, which will reduce stump sprout growth and brush growth. Conifers greater than 8" DBH will not be cut.

TSI stands will be treated by hand or by mastication. Mastication would involve use of low ground-pressure mechanical equipment (similar to a mowing machine) used to cut live vegetation. Material would be masticated up to approximately 6 to 8 inches above the ground surface. Approximately 253 acres may be masticated depending on cost and availability of equipment. If mastication does not occur the units will be hand piled and burned.

TSI Activity Fuel Treatments

Activity fuel treatments would include one or several of the following actions: hand pile and burn, and under burning with handline construction.

Activity fuel treatments will generate materials that could also be utilized as biomass, post and pole, and fuelwood/fire wood.

Table 3 summarizes the proposed timber stand improvement activities by unit.

Table 3. Timber Stand Improvement Unit Summary

Unit ID	Sub-unit	Stand Type/ Seral Stage	Est. Acres	Treatment Type	LSR/CHU
24	24a	EM	24	HPB	
25	25	EM	30	HPB	
29	29	EM	50	HPB	CHU
39	39c	EM	16	HPB	LSR
43	43	PH	22	HPB	LSR/CHU
47	47e	EM	12	HPB/UB	CHU
49	49	EM	13	HPB	CHU

54	54	EM	10	HPB	LSR/CHU
57	57b	PH	4	HPB	
76	76	EM	35	HPB	
77	77	EM	76	HPB	LSR
82	82	EM	23	HPB	
83	83	EM	28	HPB	
87	87	EM	21	HPB	
209	209	EM	8	HPB	
246	PH	PH	6	HPB	LSR/CHU
287	287	PH	8	HPB/M	
288	288	PH	7	HPB/M	
392	392	PH	5	HPB/M	
393	393	PH	5	HPB/M	
395	395	PH	3	HPB	
398	398	PH	13	HPB/M	LSR
400	400	PH	17	HPB	
401	401	PH	20	HPB	
402	402	PH	32	HPB	
404	404	PH	5	HPB	
411	411	PH	19	HPB/M	
412	412	PH	49	HPB/M	LSR
413	413	PH	45	HPB/M	LSR
414	414	PH	4	HPB/M	LSR
415	415	PH	10	HPB	
417	417	PH	35	HPB/M	
419	419	PH	13	HPB/M	LSR
420	420	PH	10	HPB/M	
421	421	PH	13	HPB/M	
422	422	PH	8	HPB/M	LSR
423	423	PH	4	HPB/M	LSR
424	424	PH	4	HPB/M	LSR
426	426	PH	7	HPB/M	CHU

430	430	PH	37	HPB	LSR/CHU
431	431	PH	45	HPB	LSR/CHU
432	432	PH	4	HPB/M	LSR/CHU

PH= pole harvest, EM= early mature, HPB = hand pile and burn; M=mastication; LSR = Late Successional Reserve and MAMU Critical Habitat; CHU= NSO Critical Habitat; D= NSO dispersal habitat

Jeffrey Pine-Grassland Restoration

Seven units (**95 acres**) are designed to restore Jeffery pine-grassland areas (Table 4). Fire exclusion has allowed vegetation such as shrubs and Douglas-fir to encroach upon the meadows. Forage value of the meadows for wildlife species has been reduced due to the dense brush but also because of the dead and matted grass preventing new growth. The project would restore the meadow areas through the use of prescribed fire to rejuvenate and reinvigorate the grass and other grassland species and to remove encroaching vegetation. In some cases, large diameter (predominant) trees would have debris raked back from the base of the tree, to protect the trees during burning. In addition, some pretreatment (hand piling and burning) of shrubs and small diameter trees will be done to protect large predominant trees and Forest Service Sensitive lichen species during understory burning and in areas of extensive brush in order break up the continuity of fuels so as to maintain a low intensity burn.

Low intensity fire would be allowed to creep into brushy areas, killing the brush and small diameter trees, maintaining approximately 10 to 20% of the small trees in these areas. Not all areas of brush would be burned; some would be retained as cover areas for wildlife. Some post treatment piling and burning may also occur in areas where brush was killed but not completely burned. The project area may initially be burned more than once in order to achieve the desired results. Burning the area more than once would allow the use of low intensity fire, which would maintain 80 to 90% of the overstory trees while reducing the amount of brush and small trees.

Hand lines would be constructed at strategic control points, especially in vegetation transition areas such as between Jeffrey pine-grassland and Douglas fir areas. The lines would be 18” to 20” wide and scraped down to mineral soil, outside of the meadow areas.

Once the initial treatment has been completed, maintenance burns would be implemented every 5 to 15 years or as the need is identified.

Table 4. Jeffrey Pine-Grassland Unit Summary

Unit ID	Est. Acres	Fuels treatment	LSR/CHU
59	32	HPB/UB	
61	6	HPB/UB	

62	7	HPB/UB	
78	22	HPB/UB	LSR
79	6	HPB/UB	LSR
80	14	HPB/UB	LSR
81	8	HPB/UB	LSR

Note: HPB = hand pile and burn; UB=understory burning; LSR = Late Successional Reserve

Sugar Pine Restoration

Three TSI units (**20 acres**) are designed to restore sugar pine *(Pinus lambertiana)* stands (Table 5). Two stands are comprised of large diameter, predominant sugar pine surrounded by dense thickets of small diameter conifers and hardwoods and one stand is a sugar pine-dominated plantation. Sugar pine-dominated stands are rare on the forest, and such stands are usually sparsely vegetated. Competition for resources is currently stressing the predominant sugar pine, and will eventually kill the larger trees. The proposed action will remove all small diameter trees under the drip line of (up to 30 feet from base of tree) of the large pines, as well as thin the understory. In the unit with pole-sized sugar pine, treatments will be similar to the TSI units described above, except that sugar pine will be favored over other species.

Culturing of healthy sugar pine would also occur throughout all commercial thinning and TSI treatments in the project. In these cases sugar pine would be favored over other species as leave trees and thinning would generally be heavier around them to promote their growth and maintain genetic diversity in light of the blister rust fungus.

Table 5. Sugar Pine Restoration Unit Summary

Unit ID	Stand Type/ Seral Stage	Est. Acres	Fuels treatment	LSR/CHU
50	EA	6	HPB/LS	
94	EA	4	HPB//LS	
244	PH	10	HPB	LSR/CHU

Note: PH= pole harvest, EA= early mature with predominants; HPB = hand pile and burn; LS= lop and scatter; LSR = Late Successional Reserve and MAMU Critical Habitat; CHU= NSO Critical Habitat; D= NSO dispersal habitat

System Road Management

Access into the Gordon Hill Vegetation and Fuels Management Project area would be by a series of Del Norte County and National Forest System (NFS) roads, between the communities of Gasquet and Big Flat, California. No new system roads would be added to the National Forest transportation system.

There are twenty-eight existing roads that serve the project area. The main roads consist of Del Norte County Roads 405 and 411, NFS roads 17N07, 17N48, 17N41, 16N19, 16N19E, 16N37, 16N21, and 15N11. The roads in the planning area are a combination of aggregate surface and native surface roads designed for hauling. Use of these roads would be subject to haul restrictions during wet weather.

Approximately 0.26 miles of new temporary roads will be constructed to facilitate mechanical treatments and product removal.New temporary roads would be located and constructed to minimize ground disturbance, and to protect resources. New temp roads are all short segments with no crossings required.existing temporary roads are generally old jeep roads or temporary roads constructed for past harvest activities. These roads require reopening and a road grader to restore the surface prior to use.

Three system roads (1.08 miles) are currently Operational Maintenance Level (OML) 1 roads. OML 1 roads are closed to vehicular traffic until needed for administrative access. Road numbers 15N11A (0.6 mi), 17N40D (0.18 mi) and 17N41A (0.3 mi) would be reopened for this project. They would be temporarily upgraded to OML 2 for the duration of the project, and then returned to OML 1 status (closed) upon completion of the project.

Approximately 2.8 miles of existing temporary roads would be utilized with minor reconstruction in some of the proposed units. Approximately 0.26 miles of new temporary road construction will be needed in order to implement activity treatments. Both the existing temporary and new temporary roads would be subsequently decommissioned after commercial treatment operations are completed. Decommissioning would generally involve one or more of the following activities: 1) sub-soiling or out-sloping the road surface; 2) removing drainage structures; 3) installing water bars; 4) mulching with native materials (logging slash) or certified weed free straw; and 5) placing earth or log mound barriers to prevent vehicle traffic.

Any fuels generated through road construction or maintenance will be hand piled and burned or chipped on site.

NFS roads that are currently open to vehicular traffic would require routine maintenance to meet project requirements. Their status would remain unchanged after the project is completed. All aggregate rock and water hole requirements for this project can be met from existing sources on National Forest lands.

Landings

The project will require 2 to 3 landings/disposal sites per unit. Existing landings/natural openings will be used as much as possible. Additional tractor and skyline landings will be mostly located within the roadbed; however some limited expansion may be needed. Landings are up to approximately 0.25 acres in size (1/3 acre for disposal sites). There are 38 existing landings/natural openings that will be used, and 9 new landings will be constructed. Existing and new skyline and tractor landings would be located either within, or adjacent to, treatment units. Construction of new landings will follow all project design features and LRMP standards and guidelines. Anchor points above landings/unit would be needed for safety support of cable logging systems. Anchor points include 18 to 20” trees, sound snags, or heavy equipment parked above the landing. Existing and new landings would be decommissioned following project

activities.

Twenty-inch DBH trees in LSRs

The Gordon Hill Project occurs partially within LSR RC 303. Under the 1994 Northwest Forest Plan, Standards and Guidelines (S&G) were developed for silvicultural treatments in Late Successional Reserves (LSR) in order to maintain or improve habitat conditions for late-successional species. Deviations from S&Gs were required to be reviewed by the Regional Ecosystem Office (REO) to ensure that objectives for LSRs are still being met. All S&Gs of the NWFP were incorporated into the 1995 Six Rivers Land and Resource Management Plan.

In July 1999, the REO developed the "Criteria to Exempt Specific Silvicultural Activities in Late-Successional Reserves and Managed Late-Successional Areas from Regional Ecosystem Office Review" for specific types of actions they had determined would meet LSR objectives under certain conditions and would not require REO review.

One S&G required that all 20" DBH and above trees be maintained within the treated stands unless reviewed by the REO. In the July 9, 1999 letter, the REO allows "Individual trees … exceeding 20-inches DBH in any province, shall not be harvested except for the purpose of creating openings, providing other habitat structure such as downed logs, elimination of a hazard from a standing danger tree, or cutting minimal yarding corridors." The Gordon Hill Project meets LSR objectives for habitat protection and restoration, and meets the criteria needed to allow the use of the exemption. The Gordon Hill Project will require a limited amount of 20" DBH trees to be cut (currently 3 trees have been identified but additional trees may be identified during project implementation) in order to re-use existing temporary roads and landings. Any 20" tree cut will be done to meet LSR objectives. The trees will be cut and left on site as downed woody debris.

Proposed Action Summary

Table 6 summarizes all treatment proposed for the Gordon Hill Vegetation and Fuels Management Project.

Table 6. Proposed Action Summary

Fuel Treatments	
# Units	82
Acres	1168

Commercial harvest	
# Units	41
Acres	665
Miles of existing temporary roads	2.8
Miles of new temporary road constructed	0.26
# Existing Landings/natural openings	38
# New landings	9
Timber Stand Improvement	
# Units	42
Acres	801
Restoration (Jeffrey Pine-Grassland and Sugar Pine)	
# Units	10
Acres	115
Total	
# Units	175
Acres	2749

Project Design Features

Project Design Features are incorporated into the design of the project activities described above and are intended to reduce, minimize, or eliminate impacts to various natural and human resources and ensure the project is in compliance with the resource protection standards and guidelines of the Six Rivers National Forest LRMP, the Region 5 Soil Management Handbook (FSH 2509.18), Six Rivers National Forest Best Management Practices (BMP) for Invasive Plant Species and Aquatic Organisms (2014), Regional and State Water Quality BMPs, and the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USFS et al. 2001) based on the district court's remedy order issued on February 18, 2014 (Conservation Northwest v. Bonnie, W.WA No. C08-1067-JCC). The design features identified through an interdisciplinary team review are listed below by resource.

Soil Productivity

1. Skid roads, trails and landings would be limited to no more than 15% of the harvest area (LRMP S&G 1-4, p.IV-71). Reuse existing skid trails and landings to the greatest extent possible. When these guidelines are followed, soil porosity

should be maintained to at least 90% of its natural condition over at least 85% of the unit area (LRMP S&G 1-2, p.IV-71).

2. Ground based equipment would generally be limited to slopes of 35% or less in order to minimize soil disturbance and subsequent erosion (LRMP S&G 1-8, p.IV-71). This may require equipment exclusion areas in portions of units. End-lining would be used within portions of ground based units with slopes greater than 35 percent. Limited skid trails are allowed within small inclusions of steep areas exceeding 35 percent (pitches up to 50 feet and less than 45 percent slopes). These shall be covered with enough slash to provide soil cover for erosion control on the bare areas, in addition to waterbars. Utilize coarse woody debris (CWD) by placing at an angle to the trail to both break up flow and divert water off the trail. Minimize equipment turning on pitches exceeding 35 percent to reduce bare soil exposure and soil displacement.

3. To reduce the potential for soil erosion and compaction to fine textured soils tractor skidding would be allowed only when the top 10 inches of soil is dry.

4. Skid roads, trails and landings shall receive post-activity erosion control measures and soil rehabilitation, including sub-soiling, water-bars, shaping and mulching/slash treatments.

5. Sub-soiling would occur on ground based units with post-activity soil compaction exceeding the LRMP standard. Monitoring by sale administrator and soil scientist will determine if sub-soiling is warranted.

6. New or reconstructed temporary roads shall receive post-activity erosion control measures, drainage improvement and rehabilitation. Subsoiling treatments shall be conducted to a depth of 18 inches where feasible. Some soils that are extremely rocky or shallow would not receive these treatments. Other erosion prevention measures may also be considered (i.e. installation of cross ditches, rock armoring, silt fences, straw bales, mulch, slash, etc.) would be used as necessary to direct water to areas of suitable drainage and capture sediment. Mulching and seeding treatments are described under Botany PDFs.

7. Landings used during wet weather/winter operations would be rocked prior to surface saturation (Six Rivers National Forest Wet Weather/Winter Operating Standards). Log haul on temporary roads would be allowed only during the normal operating season under dry conditions.

8. One-end or full suspension of logs for cable yarding operations is required. Cable corridors will have hand-waterbars installed where soil is exposed from partial suspension, installed prior to the first wet season or concurrent with shutting down due to wet weather.

9. Controlled burning prescriptions in all units would be designed and implemented when soils are wet enough to minimize potential impacts to soil quality while still meeting fuel reduction objectives. Broadcast burn ignition plans should be designed with target residual soil cover levels in mind. Surface litter can be charred and still provide erosion protection unless the litter has been charred to the point where there is visible bare ground in the charred patches. Contiguous (not sparse) needle cast directly after operations can be counted as cover if it

provides adequate protection (at least 0.5 inches) against erosion. The intent is to perform burning operations under appropriate fuel moisture conditions such that a minimum of 50% of the duff, or as determined by Erosion Hazard Rating (EHR) modeling, would remain in a well distributed manner across the site to protect the soil from erosion (LRMP Appendix L-1).

10. Retain existing down coarse woody debris (CWD) wherever possible and at a minimum maintain five pieces of coarse woody debris per acre as a source of organic matter for surface organisms (LRMP Appendix L-1).

11. Minor modifications of the above soil resource Project Design Features may be allowed on a site-specific basis as determined necessary and with concurrence of the project hydrologist, soil scientist, and fuels specialist. The intent of the BMP should still be met to the greatest extent possible. Adherence to the LRMP Standard and Guides, National Best Management Practices for Water Quality Management of National Forest System Lands Volume I National Core BMP Technical Guide and Region 5 FSH 2509.22 Soil Water and Conservation Handbook, Chapter10 Water Quality Management Handbook can only be achieved through implementing the above PDF's which were developed from these guides.

Fuels

1. As necessary (determined by Forest Service personnel), the purchaser may move tops and unmerchantable material to a disposal site that would be accessible to the public for fuelwood gathering.

Wildlife

1. Shaded fuelbreak construction may occur in suitable threatened, endangered and sensitive species habitat. No overstory trees or overstory canopy would be removed; however, in areas where the existing overstory canopy closure is low (but greater than 40%) treatments in secondary or understory canopy layers should maintain a minimum overall canopy closure of 60%.

2. In fuelbreak areas where treatments need to occur in NSO nesting habitat in order to maintain the effectiveness of the fuelbreak, only reduce fuel concentrations within 50 ft. of main roads. In mid-mature stands that contain moderate quality NSO foraging habitat treat the first 50 feet (roadside) and, if it occurs, the 50 feet nearest the ridge top following the standard fuelbreak prescription described above. In the remaining 50 to 100 ft. (depending if the area is adjacent to a ridge top), 40-50% of existing brush will be maintained in a mosaic pattern for prey species cover. Overstocked trees <8" DBH will still be reduced and pruning of residual trees will still be allowed in these areas.

3. The project would not remove potential threatened, endangered, and sensitive species nest trees (predominants) or affect the canopy around potential nest trees in suitable habitat. Directional falling would be used to protect all predominant trees and the any tree forming a canopy around the predominants.

4. Snags and logs would be retained as per Six Rivers National Forest LRMP, Standard and Guidelines Table IV-8, and Appendix L. Treatments within Late-Successional Reserves, Riparian Reserves, Critical Habitat Units, and suitable Northern spotted owl habitat (regardless of land allocation) would maintain snags (20" DBH and greater or the largest available in younger seral stages) and downed logs (20" and greater and at least 10 feet long or the largest available) at the 80 to 100% level, unless they pose a safety hazard or would not meet fuel treatment objectives. Hazard trees are defined as any tree that is dead, dying, or showing signs of failure that has the potential to hit the area of operations (leaning toward the site and is within tree-height distance).

5. Surveys for the northern spotted owl (NSO) have been conducted to determine occupancy and nesting status. Prohibit all timber harvest, heavy equipment use, chainsaw use, and smoke producing activities within 0.25 miles of known NSO activity center from February 1 through July 31.

6. Radar surveys for the marbled murrelet (MAMU) have been conducted, with no detections. It is unlikely that MAMU are nesting in the project area; however no stand-specific audio-visual surveys were conducted. A limited operating period of March 24 to August 5th will be imposed on all noise and smoke generating activities within 0.25 miles of high quality MAMU nesting habitat. If MAMU are subsequently detected in or adjacent to the project area, prohibit all timber harvest, heavy equipment use, chainsaw use, and smoke producing activities within 0.25 miles of the occupied site from March 24 through September 15.

7. Surveys for goshawk in the project have been conducted, with no detections. If nesting goshawks are subsequently found within 0.25 miles of any treatment units, prohibit all timber harvest, heavy equipment use, chainsaw use, and smoke producing activities within 0.25 miles of the occupied site between March 1 and August 31.

8. Surveys for fisher, marten and wolverine have been conducted and fishers have been detected in 3 areas. Although no den sites have been located, prohibit all timber harvest activities including heavy equipment use, chainsaw use, and smoke producing activities within 0.25 miles of fisher suitable denning habitat around detection areas from February 1 to May 31.

9. In early seral-stage stands lacking downed woody debris (shrub and pole seral stages), small diameter slash would be piled and left on site to provide cover for small mammals, birds, reptiles and amphibians. The size of the piles would vary depending on the availability of slash; however the preferred size is at least 6 ft. in diameter and 4-6 feet tall. Small diameter debris decomposes quickly, so large piles may have greater longevity. The number of piles per acre would be dependent on the location and potential fire risk. In high public-use areas, only 1 or 2 piles per acre would be left in the stand. In other areas, 3 to 4 piles per acre would be left in the stand. No piles would be left within 100 feet of roads.

Port-Orford Cedar

To reduce the risk of introducing Port-Orford cedar root disease into the project area, the following would be implemented:

1. Limit road reconstruction and decommissioning to the dry season only.

2. Limit operating season of the timber sale to the drier months. No operations may occur between October 15th and May 15th without written approval by the Forest Service.
3. No surface maintenance on gravel roads would occur when road conditions are wet (such as during or immediately after rainfall).
4. Wash mud and dirt from earth moving, yarding, loading, and other support equipment prior to beginning work on the project site and following completion of work.
5. Equipment must be washed before entering the project area or leaving the area and between any units containing POC at a site approved by the Forest Service
6. Timber haul and purchaser vehicles will not travel from an infected to un-infected area without washing.
7. Avoid using water for dust abatement that may be potentially infected with root disease. If a potentially infected water source must be used, treat with Clorox brand chlorine bleach (away from the water source) before application (1 gallon of Clorox per 1000 gallons of water). Use chlorinated water to wash all vehicles and heavy equipment.

Riparian Reserves

1. All RR within the project area have been identified on the ground in accordance with the Aquatic Conservation Strategy (ACS). For the Gordon Hill Project, RRs were designated with a width of 160 feet on each side of channels. A width of 160 feet represents an average site potential tree height. In addition, active and potentially unstable areas were excluded from all treatment units.
2. Commercial thinning in RRs would be not allowed within 80 feet of all stream channels, or the break in slope at the edge of the inner gorge, whichever is greater. 80-foot inner gorge no-treatment buffers are expected to protect streams from: 1) sedimentation from ground disturbance involved in thinning and removal, and 2) temperature and microclimate impacts from canopy reduction immediately adjacent to the channel.
3. Timber stand improvement, fuelbreak construction, and burning will not be allowed within 50 ft. of stream channels. Hand piling and pile burning may only occur within a RR if the handpiles are 6 feet or less in diameter, and less than 6 feet in height.
4. No ground disturbing machinery would operate within RRs. Thinning and release work within RRs would be accomplished with small gas powered hand tools (e.g. chainsaws, brush cutters). Removal of trees and vegetation may occur by cable yarding upslope with a yarder located outside of the RR. Directional felling away from the stream bank is required for all vegetation removal within the RRs.
5. Canopy closure in RRs would be maintained at 60% or greater except in young stands proposed for TSI (pole seral stage) which may be reduced to 40% canopy closure.
6. Landings and disposal sites are to be located outside of Riparian Reserves.

7. Ignition may occur within RRs only when necessary to minimize underburn intensity and/or the potential for burning material to roll down into a RR.
8. No fire line (scraped to mineral soil) would be constructed within RRs; however cut brush line will be allowed for holding purposes on prescribed fires
9. Best Management Practices (BMPs) would be followed for activities associated with the project to be in compliance with the Clean Water Act (Appendix E).

Unstable Riparian Reserves

All active and potentially unstable areas were excluded from all treatment units; however if additional unstable areas are located during implementation:

1. Active and potentially unstable areas (unstable Riparian Reserves) are to be excluded from all commercial treatment units. Excluded areas will be demarcated in the field prior to treatment.
2. Selective hand treatment in fuels management and timber stand improvement units would be permissible in unstable Riparian Reserves. No conifers greater than 8" are to be removed. Vegetation that provides stream bank stability, or landslide scarp stability, would not be removed. In native and lightly managed native stands, hand fuel treatments in Riparian Reserves would occur only where there are areas or pockets with high concentrations of fuels.
3. Where variable density thinning is applied within Riparian Reserves, no harvest-created gaps or openings will be located on geologically sensitive terrain.
4. No skyline corridors shall cross a Riparian Reserve that includes unstable areas without geologist field review.
5. Temporary roads will be constructed to minimize impacts to Riparian Reserves. No temporary roads will cross a Riparian Reserve designated for instability. Temporary roads will be decommissioned when they are no longer needed for project implementation.

Sensitive Plant/Fungi Species and Survey and Manage Plant Species

Project design features below will be incorporated to reduce the risk of impacts to the Forest Service Sensitive plant and fungi species, and Survey and Manage (SM) plant species.

No-treatment buffers have been demarcated around occupied Sensitive and SM plant species, specifically:

1. With the exception of hand removal of dead fuels as necessary, no activities shall occur within an approximate 25-foot radius of trees (essentially within the extent of the tree crown) occupied by *Usnea longissima* (Sensitive and SM) in the following units: 7 (1 tree) and 78 (3 trees); by *Lobaria oregana* (SM) in units: 87, F13B and F43A. Where these species occupy more than one tree within less than 50 feet from one another the buffer shall incorporate the aggregate of trees that comprise the known site.
2. A protected area has been identified in F19A for *Lewisia oppositifolia.* No piling

and burning of brush or handline construction will occur within the protected area. Excess fuels that are cut from the protected area will be moved out of the no-treatment area and burned. For the *Lewisia oppositifolia* site in unit 59, no piling and burning of brush or hand-line construction will occur in occupied habitat. Concentrations of brush can be piled and burned where it is cut.

a. Within occupied habitat for *Lewisia oppositifolia*, prescribed fire implemented for maintenance of vegetative conditions that is occurring at less than 5 year intervals, shall not occur during the above-ground growing season (March through July) for this species.

3. With the exception of piling shrub vegetation where it is cut and burning the cut shrub material where piled, no piling, burning of brush or handline construction will occur within the habitat occupied by *Silene serpentinicola* in unit 80. A proposed landing coincides with the occurrence and if necessary will be relocated or reconfigured to avoid direct or indirect impacts to this species.

   a. In unit 81, *Silene serpentinicola* plants are scattered in patches or as individuals throughout the Idaho fescue grassland; therefore, no buffer was established in the field. In this unit, if possible, avoid constructing handline through the grassland by locating the handline on its periphery. In addition, a study plot of about 1/10th acre was established to evaluate the effects of prescribed burning on *Silene serpentinicola*. If monitoring indicates a decline in the species abundance, the burn prescription will be adjusted.

   b. Within occupied habitat for *Silene serpentinicola*, prescribed fire implemented for maintenance of vegetative conditions that is occurring at less than 5 year intervals, shall not occur during the above-ground growing season (April through August) for this species.

4. In F19 and F20, no piling, burning of brush or hand-line construction will occur within the occurrence of *Packera hesperia.*

5. With the exception of hand removal of dead fuels as necessary, no activities shall occur within areas buffered for *Prosartes parvifolia* in units 44 or F12A. In unit 47, no activities shall occur within the buffered area with the possible exception of skid trail reconstruction/use if deemed necessary. Given the species early-successional habit and its presence in settings with little to no canopy cover, if said skid trails are needed to implement the project, a botanist shall be consulted during layout to best assure individual plants are not directly impacted.

6. In order to maintain the effectiveness of a fuelbreak, treatments in fuelbreak areas that coincide with potential Survey and Manage/Sensitive fungi habitat (mid-mature and late-mature stands) will reduce fuel concentrations within the first 50 feet (roadside). Additionally, in mid-mature stands that contain potential Survey and Manage/Sensitive fungi habitat, treat the 50 feet nearest the ridge top following the standard fuel break prescription described above and maintain 40-50% cover of shrubs in the remaining fuelbreak area to provide habitat components for fungi (see Wildlfie PDF #2 above). Overstocked trees <8" DBH

will be reduced and pruning of residual trees will be allowed in all fuelbreak areas.

Noxious Weeds

1. Scotch broom (36 sites), French broom (3 sites), English ivy (1 site), tansy ragwort (3 sites), and meadow knapweed (2 sites) sites were identified and flagged within or roadside adjacent to the following units: 1, 3, 5, 9, 23, 24, 25, 45, 47, 52, 54,57, 58, 59, 75, 76, 80, 81, 82, 83, 84, 87, 92, 243, F01A, F02A, F03A, F05A, F06A, F07B, F08A, F09A, F10A, F11A, F12A, F13B, F15A, F16A, F18A, F31A, F32A, and F36A.

    a. Scotch and French Broom:

        i. To reduce the risk of spread within unit boundaries concentrations of broom species will be removed in the course of the fuel treatment, piled on top of the sites where removed, and burned to kill above-ground plants and possibly some of the broom seed stored in the bank. (See English ivy design feature below). Broom removal will very likely need to be maintained by a designated crew.

        ii. Where coinciding with landings/clearings, remove broom plants (including roots) using weed wrench if number of plants is relatively small; where large concentrations occur, mechanically remove broom to the landing edge where it won't be disturbed by landing operations. Pile and burn as needed.

        iii. Where associated with road edges that coincide with units or fuelbreaks only, remove using weed wrench or hand pull. In both cases ensure that the roots of the shrub are removed. In addition, where broom is heavily concentrated (e.g. sections along County Road 411, "feather" treatment so as to provide some vegetative barrier between the road and the fuel break. Thin lightly or maintain existing vegetation on the edge for about 30 feet deep before more intensive treatment.

    b. Meadow knapweed: The two sites of meadow knapweed are in the vicinity or coincide with proposed landings associated with units 24 and 76/4A. No ground disturbing activities shall occur in the immediate vicinity of these sites.

    c. English ivy: This invasive was only detected in unit 1 in association with scotch broom. Ivy shall be pulled (and later burned) prior to commercial thin implementation to reduce the risk of spread on equipment from unit 1 to another unit. It is likely that the ivy removal will need to be maintained by a designated crew to reduce the potential for overtopping of trees.

    d. Tansy ragwort: Relative to the landing in unit 58, hand pull tansy ragwort plants, pile and burn or remove from site. After operations, cover landing with light layer of slash or chipped material to reduce the incidence of tansy ragwort seedling germination.

2. Where new or existing temp roads to be used in the course of project implementation are coincident with noxious weed sites, cover first 10-15 feet of temp road with chipped material at the intersection of the temp and system road.

3. Use of any foreign material (e.g. rock aggregate, mulch) shall come from a weed-free source.

4. Equipment cleaning measures identified under Port-Orford-cedar design measures would be implemented to reduce the risk of incidental import of noxious weed seed on equipment to uninfected areas.

Air Quality

1. Dust abatement with water or other abatement material would be required during hauling operations. Avoid using water for dust abatement that may be potentially infected with POC root disease. If a potentially infected water source must be used, treat with Clorox brand chlorine bleach before application (1 gallon of Clorox per 1000 gallons of water).
2. Burning would only be conducted on days approved by the North Coast Unified Air Quality Management District.
3. New temporary roads in ultramafic bedrock shall be subject to dust abatement mitigations and processes outlined in the California Air Resources Board (CARB) Air Toxic Control Measure (ATCM) for construction, grading, quarrying and surface mining operations.

Visual Quality

The project meets all visual quality objectives in the LMRP.

Cultural Resources

1. General design features necessary for proposed activities to occur in and around archaeological sites:

    a. Site boundaries will be flagged prior to implementation of this project.

    b. No ground-disturbing activities (e.g. skidding, use of tracked equipment, construction of temporary roads or landings) will be allowed within site boundaries.

    c. Landings will be located well away from archaeological sites.

    d. No staging of heavy equipment will occur within site boundaries.

    e. Hand thinning (i.e. loppers, chainsaws) will be allowed within site boundaries, with minimal ground disturbance (i.e. hand bucking, hand

carrying), but only when a Forest Service archaeologist monitor oversees the work.

f. Directional felling will be required when deemed necessary by a Forest Service archaeologist.

g. All slash will be piled away from sites.

h. Low-intensity understory burns will be allowed across sites, provided the sites have no flammable features and the fuel load is low prior to ignition.

i. Fire containment lines will be located such that they do not disturb archaeological sites.

2. Site-specific design features have been prescribed for two distinct site types: 1) sites with elements susceptible to ignition from prescribed burning (e.g. wooden features); and b) sites defined by extensive linear features that are at-risk of mechanical equipment incursion (e.g. ditches and canals).

    a. *Sites with Wooden Features*: Twelve sites are considered "fire-sensitive" because they have wooden features.

        i. All wooden features will be protected from fire using a variety of methods, including: removing downed logs and heavy brush, constructing fire lines around structures, backfiring, utilizing fire resistant materials or wetting agents, and/or on-site monitoring during activities.

        ii. Burning may be prohibited near these sites if no other means of protection can be accomplished.

    b. *Historic Ditches and Canals*: Six sites with linear elements are considered to be "at-risk" from mechanical equipment incursion. All six sites contain extensive linear resources that may need to be crossed by heavy machinery. Acceptable locations where the ditches/canals may be crossed have been designated in the confidential Cultural Resources Inventory Report, Addendum (R2014051011045), on file at the Six River's National Forest Supervisor's Office.

        i. Crossings will be allowed where site integrity is clearly lacking. Project managers and on-the-ground personnel will be notified of these locations prior to implementation.

ii. Crossings will be made perpendicular to ditches/canals, and only under the direct supervision of a Forest Service archaeologist.

iii. Trees will be felled directionally away from ditches/canals to prevent damage.

iv. Trees in or near the walls of ditches/canals will not be cut if they are providing bank stability.

Monitoring Requirements

Monitoring is an ongoing process by which the effectiveness of planning and accomplishment are measured. Implementation monitoring focuses on ensuring that activities and design features specified in the planning process are carried out; they include the following:

- The layout forester and fuels specialist would ensure that all unit design features are accomplished.
- Delineate location of buffer areas and noxious weed locations in the field, on the project area maps, on stand record cards and in burn plans.
- In the Jeffrey pine restoration Unit 81 and Camp Six areas, conduct pre- and post-treatment monitoring in accordance with monitoring plan to evaluate effects of prescribed burning on *Silene serpentinicola*.
- In the Jeffrey pine restoration Units 80 and 81, monitor scotch broom sites associated with the respective area and treat if plants are detected.
- The layout forester or silviculturist would inspect the mark to ensure that marking guidelines are followed.
- The timber sale contract preparation officer would include all relevant contract clauses in the timber sale contract package that are needed to fulfill the specified design features of the project.
- Key specialists in the interdisciplinary team would check the contract document to ensure that all design features specified in the environmental assessment are included in the contract.
- The timber sale administrator would ensure that all contract clauses are enacted.
- Members of the interdisciplinary team may conduct field reviews to inspect the unit boundary delineations, buffers and marking, as well as during timber sale and post-harvest operations to ensure project design feature implementation.
- Prescribed burning operations would conduct post burn evaluations to determine implementation success in terms of fire behavior and resource objectives.

- Smoke Impacts: dispersal and air quality monitoring will be followed as required by North Coast Air Quality-Eureka division

Effectiveness monitoring would be conducted for the following:

- Implemented National (2012) and Regional (2012) Water Quality Best Management Practices (BMPs) listed in Appendix E. Onsite evaluation of BMPs would be conducted according to protocols established by the Best Management Practices Evaluation Program (BMPEP). Currently both the Region 5 and National BMPEP's are being utilized by Six Rivers National Forest in order to meet Regional targets required for each program. It is anticipated that future Regional direction will only require National BMPEP targets. BMPs will be implemented accordingly for land disturbing activities as a means to achieve state water quality objectives.
- Effectiveness of noxious weed project design features. Roadsides, landings, or other areas disturbed in the course of project implementation shall be monitored one year after project completion to ensure weed seed was not introduced. Additionally, known sites shall be monitored to ensure noxious weed occurrences did not increase at or move beyond existing sites as a result of project implementation. Monitoring shall be implemented by fuels, forestry and botany staff as identified in the invasive and noxious weed specialist report and correspondingly on stand record cards and burn plans.

Alternatives Considered but Eliminated from Detailed Study

A comment was received that LSR stand conditions are in "dire need of treatment and the proposed action of leaving 40-60% crown closure will only temporarily meet your long-term desired condition". The commenter asked for an alternative to be analyzed that would require no more than two entries in LSR to meet the long term objectives.

The alternative was considered yet not further evaluated because the treatments as designed would result in minimum recommended stand stocking densities while still meeting the objectives of the LRMP for the LSR. Site-specific analysis will be required in the future (20 to 30 years) to determine what, if any, additional treatments would be required. The prescription as proposed will protect existing habitat characteristics, and would accelerate the development of important characteristics that are currently lacking. The proposed project will meet S&Gs and objectives for LSR as described in the LRMP, and therefore will meet the purpose and need for the project.

Comparison of Alternatives

This section provides a comparison of the two alternatives considered in detail on the basis of attributes and connected actions (Table 7). It also compares the alternatives by how well they meet the project objectives described in the Purpose and Need section, and by estimated effects on resource values discussed in Chapter 3 (Table 8).

Table 7. Comparison of Alternatives by Attributes and Connected Actions

Design Attribute/Connected Actions	Alternative 1 **No Action**	Alternative 2 **Proposed Action**
Commercial Thinning / Activity Fuel Treatments (CT Units)		
Commercial Thinning Area (acres)	0	665
Total Timber Volume Yield (MBF)	0	4,000
Tractor/Mechanized Harvester (acres)	0	521
Cable Yarding (acres)	0	144
Existing Landings Reutilized	0	38
New Temporary Landings	0	9
Existing Temporary Roads Reutilized / Decommissioned (miles)	0	2.8
New Temporary Roads constructed/decommissioned (mi)	0	0.26
Hand Piling and Burning (acres)	0	665
Underburn/Hand Line Construction (acres)	0	386
Biomass / Fuelwood Utilization Opportunities (acres)	0	all
Timber Stand Improvement / Activity Fuel Treatments (TSI Units) and Sugar Pine Restoration Units		
Timber Stand Improvement (acres)	0	801
Hand Cutting of Brush and Trees (TSI-Unit acres)		542-801
Hand Piling and Burning (TSI Unit acres)	0	542-801
Understory Burning (TSI Unit acres)	0	12
Mastication (TSI Unit acres)	0	0-253
Hand Cutting of Brush and Trees	0	20

Design Attribute/Connected Actions	Alternative 1 **No Action**	Alternative 2 **Proposed Action**
(Sugar Pine Restoration-Unit acres)		
Hand Piling and Burning (Sugar Pine Restoration Unit acres)	0	10-20
Lop and Scatter (Sugar Pine Restoration acres)	0	0-10
Biomass/Fuelwood Utilization Opportunities (acres)	0	all
Fuel Treatments (F Units) and Restoration (J-Pine units)		
Fuelbreak Constructed (acres)	0	1168
Hand Cutting of Brush and Trees (F-Unit acres)	0	1168
Hand Piling and Pile Burning (F-unit acres)	0	1168
Understory burning (F-Units acres)	0	487
Hand Cutting of Brush and Trees (Restoration Unit acres)		95
Hand Piling and Pile Burning (Restoration Units acres)	0	95
Understory burning (Restoration Units acres)	0	95
Biomass/Fuelwood Utilization Opportunities (acres)	0	all
System Road Management		
Road Maintenance (miles)	0	21.84
Road Reconstruction / Re-closure (OML 1 miles)	0	1.08

Table 8. Comparison of Alternatives by Estimated Effects

Purpose and Need Element	Alternative. 1 No Action	Alternative 2 Proposed Action
Fuelbreak Constructed (acres)	0	1168

Purpose and Need Element	Alternative. 1 No Action	Alternative 2 Proposed Action
Fuel Loading	High	Reduced
Predicted Fire Behavior	High	Reduced
Fire Risk along Travel Routes	High	Reduced
Fire Suppression Effectiveness	Low	Improved
Habitat Restoration in Early Seral Stands and Grassland	0	1555
Average Pole Stand Basal Area (sq. ft/acre)	168-314	80-120
Early Seral Stage Stands Treated (acres)	0	1460
Grassland Restoration (acres)	0	95
Other Environmental Components	Alternative. 1 No Action	Alternative 2 Proposed Action
Soil Productivity / Soil Quality Standards Met	n/a	Yes
Riparian Reserves Improved (acres)	0	62
Cumulative Watershed Effects (%ERA) (range of watershed values)	1.7%-3.7%	1.7%-4.8%
Wildlife--Threatened, Endangered and Sensitive Species	No Effect	Threatened Species: May affect. not likely to adversely affect; long term beneficial effect Sensitive Species: May impact individuals, but will not lead toward a trend in federal listing
Fisheries—Threatened, Endangered and Sensitive	No Effect	Threatened Species: No Effect Sensitive Species: May impact individuals, but will not lead toward a trend in federal listing
Botany--Sensitive Species (no T&E species affected)	No Impact	May impact individuals, but will not lead toward a trend in federal

Purpose and Need Element	Alternative. 1 No Action	Alternative 2 Proposed Action
		listing;
Survey and Manage Species—Fauna/Flora/Fungi	No Impact	Fauna- No Impact Flora and Fungi no impact to site
Invasive and Noxious Weed Species / Risk of Spread	Low	Moderate
Port-Orford-Cedar Root Disease / Risk of Spread	Low	Low
Economics / Present Net Value of Total Project ($)	0	-$3,077,355
Economics / Economic Viability of Commercial Harvest Component—Projected Bid Value to Purchaser ($)	0	$473,038

Chapter 3 - Environmental Consequences

Introduction

This chapter describes the important effects of each alternative, including direct, indirect and cumulative effects. It also presents the scientific and analytical basis for the comparison of alternatives. The first section of this chapter provides an overview of past, present, and reasonably foreseeable actions and events that would be considered in the analysis of cumulative effects for various resources. The second section compares the effects of the Proposed Action and No Action relative to achieving the objectives of the purpose and need for the project. The final section summarizes effects on environmental components that warrant mandatory disclosures required by laws, regulation, and policy. Comparison of alternatives relative to the project objectives and effects on key environmental components discussed in this chapter are summarized in Tables 7 and 8 displayed in Chapter 2.

The discussion of effects uses existing information included in the Six Rivers LRMP, Smith River LSR Assessment and Watershed Analysis USDA (1995a), Del Norte County Fire Safe Plan, and other sources as indicated. Where applicable, pertinent information from other documents is briefly summarized and referenced. The planning record includes all project-specific information, including specialist reports, project planning meeting notes and other results of field investigations. The planning record also contains information resulting from public involvement efforts. Information from the record is available upon request.

Cumulative Effects Analysis Assumptions

Cumulative effects analysis requires consideration of past, present, proposed, and reasonably foreseeable actions on both Federal and non-Federal lands. Many of the environmental effects analyzed in this EA are based on Six Rivers National Forest vegetation mapping, as well as other Federal and private lands harvest history records. Vegetation mapping was updated using 2000 aerial photo imagery and includes all Federal and private lands within the Forest's administrative boundary. It is assumed that all harvest activities affecting forest vegetation prior to 2000 were accounted for in the mapping. The vegetation layer for the North zone was updated to 2006 for this project to reflect natural disturbance and management induced changes since 2000.

Cumulative effects analyses are conducted at various temporal and spatial scales, depending on the resource value analyzed. The following section provides an overview of the past, present, and reasonably foreseeable future actions or events that occur within the bounds of 5 watersheds: the Lower Middle Fork Smith River (27, 270 acres), Lower South Fork Smith River (27,377 acres) Hardscrabble-Myrtle Creek (17,800 acres) Craig's Creek (11, 540 acres), and Hurdygurdy Creek (19,162 acres). The project area encompasses approximately 42,724 acres within these watersheds.

The complete cumulative effects discussion is located in Appendix D.

Effects on Elements of the Purpose and Need

This section compares the Proposed Action with No Action relative to the purpose and need objectives for the project. As described in Chapter 1, the objectives are:

- Reduce hazardous fuel loading in strategically located high-risk areas to enhance the defensibility between the communities of Big Flat and Gasquet, and to protect existing late-successional habitat within the LSR.
- Accelerate development of late-successional habitat characteristics in plantations and young natural stands,and restore ecological conditions in special habitats (LSRs, Riparian Reserves, sugar pine stands and Jeffrey pine grasslands). The proposed action will meet the objectives of the Smith River NRA LSRA, the 2011 Recovery Plan for the Northern Spotted Owl, the 2012 NSO Critical Habitat Rule, and the Aquatic Conservation Strategy.
- Provide biomass utilization and forest commodities in the form of timber, post and pole, fuelwood/fire wood or wood chips.

The degree of attainment of these objectives centers on the estimated response to proposed silvicultural activities on vegetation and fuels in the stands targeted for treatment. The modeling program Forest Vegetation Simulator (FVS) and its Fire and Fuels Extension (FFE) were used to develop and test restoration prescriptions and to compare effects of the Proposed Action with the No Action alternative. The FVS (Dixon and Johnson, 2008) starts with general information about existing stand condition, then projects growth and development later in time. The model was designed using years of forest inventory data about how stands grow and develop in this region of the United States. The model was customized by collecting and inputting stand measurements from selected plantations and young natural stands in the project area (collected in 2009). This addition of site-specific information (such as tree species, tree diameter and number of trees per acre) adjusted the model and improved its ability to forecast how stands would grow and develop under the alternative scenarios of treatment vs. no treatment. The results of the modeling provided measures and basis for comparison of the alternatives, such as projected number of large trees per acre, fuel loadings, and number of dead trees per acre.

The FFE component of the model was used to project how fire would behave (height of flames, rate of fire spread, severity, etc.) in stand conditions that would be present under the Proposed Action and No Action alternatives. Since fire burns differently under different weather conditions, the FFE model was customized by inputting data recorded at a local weather station). By using the FVS-FFE model, it was possible to project what proportion of treated stands would probably be killed under a late summer wildfire scenario in the project area.

Fire and Fuel Conditions

This section discloses the effects of the alternatives on fuel loading, predicted fire behavior, and

fire suppression effectiveness within strategic locations relative to the Big Flat and Gasquet Communities and the LSR. The strategic locations were defined as designated fuelbreak areas determined by the Del Norte CWPP and District fuel specialists. The prescribed fuelbreaks which encompass approximately 1168 acres and run parallel to approximately 31 miles of major travel routes would be constructed and would form the basis for the following discussion on effects to these fuels and fire elements. Once treatments and activity-generated fuels are fully treated in commercial and TSI units, these areas will provide an additional 4 miles of roadside/ridge top treatments and will be considered part of the fuel break corridor system.

Alternative 1 (No Action)

Direct and Indirect Effects

Under the No Action alternative, no commercial thinning, timber stand improvement, fuels treatments or strategically located fuelbreaks would be constructed. The No Action alternative would not change the current conditions. There would be no direct effects on fire behavior specifically to the torching index and potential flame lengths. There would also be no direct effect to the fuel loading. Aggressive fire suppression would continue to be the only strategy available during critical fire weather periods.

Fuel treatments would not occur, so no reduction in predicted fire behavior (torching index, flame length) and fuel loading, or increase in fire suppression effectiveness would result. Fire severity and intensity would continue to compound as crown fire potential continues to increase through time and space. LSR 303 would continue to be at risk to wildfire. 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 (more use of dozer lines as control features).

Cumulative Effects

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. 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 for vegetation to continue to grow denser and increase the risk for high-intensity wildfires.

Alternative 2 (Proposed Action)

Direct and Indirect Effects

There would be immediate effects to fire behavior and fuel loading. Available canopy fuels will be decreased in the commercial thinning units decreasing the crown fire potential. Available brush and canopy fuels (live fuels) will be decreased in the fuels units and dead fuel loading will also be decreased resulting in a reduction in potential fire behavior. The available live and dead fuels in the TSI units with handpiling burning of activity fuels will also see a reduction in potential fire behavior. Restoration units (10 acres) with lop and scatter type fuels treatment would decrease in potential fire behavior overall (flame lengths or fireline intensity), but would have an increase in rate of spread from dead and downed materials. Those units treated with lop and scatter prescription are more remote and inaccessible, and therefore generally have less potential for human caused ignitions.

Potential fire behavior would decrease and fire suppression effectiveness would increase. There would likely be less potential impacts to private property. The effectiveness of using roads for evacuation routes would be increased along with safer access for fire suppression resources. 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. 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% of the burn area (USFS Region 5 Soil Quality Standards and Guidelines), retain large down woody material and 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.

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.

Cumulative Effects

The project is located near the community of Big Flat and Gasquet in Del Norte County CA in the vicinity of Craig, Coon, Gordon, and Hurdygurdy Creeks along the western edge of the Klamath Mountains physiographic province. The project boundary encompasses the Wildland Urban Interface (WUI) surrounding the Big Flat and Gasquet community. The current vegetation consists of predominately Tanoak/Douglas-fir stands, Douglas-fir/redwood, Jeffrey pine grasslands, sugar, western white, lodgepole, and knobcone pine stands in a mix of seral stages distributed in a fragmented pattern across the landscape. Past human caused disturbances such as aboriginal burning, cattle and sheep grazing, and mining has had an impact on the area. More recent management activities such as logging and recreation have had a significant impact on the seral stage distribution.

Fire regime condition classes within the project area have been altered by fire suppression, logging, mining, and wildfire occurrence. Aggressive suppression activity over the last 80 years has resulted in unnatural fuel profiles that are more continuous, both horizontally and vertically. Given a fire start, resulting wildfires could become larger and more destructive than in the past. The absence of fire has decreased the abundance of some old-growth forest types that are dependent on frequent, low intensity fires. Weather variations, whether related to long-term droughts or possible climate change trends, may also increase the number of dead trees and the amount of dead fuels.

As with most of the western National Forests, the suppression of wildfire in the project area has led to changes in successional pathways and increases in fuels, especially in plant communities that are fire dependent. There has been a reduction in old-growth forests and an increase in shrub, pole, and early mature forests. This shift in seral stage distribution is highest in the tanoak and Douglas-fir series, due to harvest of commercially valuable old-growth Douglas-fir stands that began in the late 1950s. Young plantations now occupy most of the harvested old-growth sites on National Forest system lands. Early and mid seral stages of Douglas-fir are more susceptible to mortality by wildfire than older, late seral stands. Thick, corky bark on the lower bole and roots of older trees protects the cambium from heat damage. In addition, the tall trees have their foliage concentrated on the upper bole, which makes it difficult for fire to reach the crown; however, trees are typically not free of lower branches until they are more than 100 years

old (Hermann et al, 1990). Stands of Douglas-fir in the Gordon Hill project area are mostly early and mid seral stage, and approximately 80 or less years old.

A fire regime condition class is the temporal and spatial pattern of fire occurrence and effects, typically described by fire return interval, seasonality, frequency, and severity. Fire regime condition classes vary with soil, climate, topography, vegetation, fire causative agents, and even previous fire patterns (Atzet and Martin 1991). The Smith River NRA is in the dry to intermediate terrestrial physiographic province. This indicates that fire has been the dominant forest disturbance factor. Typical fire return intervals and fire severities have been found to be highly variable, and wildfires did not always result in complete stand mortality. Adams and Sawyer (1980) analyzed fire scars within the Douglas-fir dominated mixed evergreen vegetation type on the Six Rivers National Forest. Their results showed a mean fire return interval of 21 years for the Smith River NRA.

From the period of 1909 to 1994, fire suppression on the Six Rivers National Forest resulted in a reduction of acreage burned annually from nearly 10,000 acres per year to less than 900 acres per year in 1994 (Jimerson, et al. 1996). From 1978 until 2012, the most recent thirty four years of statistical fire information available, 483 fires burned a total of 50,719 acres on the Smith River NRA (Six Rivers NF unpublished). Table 9 shows statistical fire information in 10-year intervals (and 2008-2012) including number of fires and acres. Statistical fire data used in Table 1 was obtained from Six Rivers NF fire reports, and processed using FireFamily Plus V4.0. The average acres burned for the past 14 years (~3,516 acres per year) more closely mimics available fire statistics prior to 1909 of nearly 10,000 acres per year; however fire severity and fire intensity is likely entirely different, resulting in more stand replacing fire events. The primary fire cause for the past 34 years is human with 355 human caused fires from 1978 to 2012. The second highest fire cause for the same period is lightning at 128 fires.

Table 9. Smith River NRA Fire History, 1978-2012

Period	# of Fires	Acres
1978-1987	84	542
1988-1997	124	948
1998-2007	235	31,633
2008-2012	40	17,596
TOTAL	483	50,719

The dramatic reduction in wildfire burn acreages over the last 80 years appears to have resulted in unnatural fuel profiles that are more continuous, both horizontally and vertically. Panoramic views from the Smith River NRA's lookouts from 1934 photos show a more open landscape, with greater amounts of shrub fields and open meadows. Given this increased conifer density, future wildfires could become larger and more destructive than in the past. Some mortality can be expected as a result of wildfires and, to a lesser extent, understory burning.

Fire regime condition classes has been disturbed and many areas have fuel build-up. The natural fire regime condition class of the area is generally comprised of frequent low to moderate

intensity surface events ('ground cleaning' or litter burning events with little tree mortality) with infrequent high intensity events (which produced patches of overstory mortality). The fire types most important in determining the vegetation patterns are not the infrequent, severe stand replacement fires, but rather the frequent low-moderate intensity fires. Frequent low-to-moderate severity fire was one of the more important ecological processes in the Klamath Province. The structure, composition, productivity and overall health and vigor of today's forests are the consequence of various types of human intervention, and this includes long-term fire exclusion.

The goal of Gordon Hill Vegetation and Fuels Management Project is to create conditions for fire resilient/resistant forests and attempts to return fire to its natural place in the environment. Post-treatment, potential fire behavior would decrease and fire suppression effectiveness would increase. There would likely be less potential impacts to private property. The effectiveness of using roads for evacuation routes would be increased along with safer access for fire suppression resources. Over time, as fuel treatments are implemented, the project would continue to reduce impacts from wildfires and increase fire suppression effectiveness. The associated cost of fighting fire (within the project area) will cumulatively decrease as the effectiveness of the fuels reduction aide in keeping unwanted fires small.

Alternative Comparison

The following section discusses assumptions used in the modeling exercise to determine measures associated with fuel profiling and predicted fire behavior under the three treatment categories and compares the alternatives on the basis of these measures.

Fuelbreaks

Fuelbreaks are created by altering surface fuels, increasing the height to the base of the live crown, and opening the canopy by removing small diameter trees, generally less than 8” DBH. By managing surface fuels and low crown stratum, fireline intensity and fire severity could be lowered to an acceptable level or below an identified critical level (Agee et al, 2000). Roadside fuelbreaks are prescribed in approximately 1168 acres of the Gordon Hill Project, primarily along major roads and connecting to other treatment units within the project area to provide connectivity and enhance strategic fire control across the landscape.

Creating fuelbreaks and fuel treatment areas would provide defensible space and strategic control lines for firefighters, and would assist with the control efforts in the event of a wildland fire threatening the community and surrounding developed areas (Bostwick et. al, 2011). In addition, fuelbreaks reduce the wildfire impacts on existing late-successional habitat both by reducing the impacts of roadside ignitions and by breaking up larger blocks of fuel.

Fuelbreaks have proven to be effective in reducing the effects of crown fire (Agee and Skinner 2005). The fuelbreaks are designed to reduce ground and ladder fuels within 8 to 10 feet of the ground along high-use roads to limit the risk of fire disturbance on a large scale and to protect large tracts of late-successional habitat. No overstory trees would be felled. The fuelbreaks would occur in all seral stages. The focus of these fuel reduction treatments is to reduce and break up the continuity of the existing fuel bed at the ground level, and to reduce fuel laddering in the lower stratum of the stands where the risk of crown fire is high. The targeted fuel for removal is brush and suppressed saplings. The desired outcome is a mosaic of live fuel reduced in height with clean mineral soil.

Fuelbreaks would be maintained on a 5-15 year interval or as need is identified.

Commercial Thinning / Activity Fuel Treatment (CT Units)

Stand and fuels information (stand exams) was collected in 2009 and used for inputs into the FFE-FVS model (Fire and Fuels Extension of the Forest Vegetation Simulator) for alternative comparisons in the proposed CT units. FFE-FVS evaluates potential fire behavior, stand mortality, and subsequent vegetation growth in the project area. All fire behavior modeling was done in order to estimate the severity that could be expected when a fire occurs during what is considered severe weather conditions. Late summer (August-September) weather conditions (hot, dry, windy conditions occurring on mid-afternoons) are generally referred to as the severe weather conditions. The August weather condition variables used in FFE-FVS simulations were taken from local weather stations and are shown in Table 2 of the Fuels Specialist Report.

Certain elements from the simulations were identified as indicators to compare effectiveness of each alternative. These elements are: flame length, torching index, and potential mortality % of basal area, and fire type.

- 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. The lower the flame lengths, the better it meets the goal of reducing adverse effects from wildfires.
- Torching index is the 20-foot wind speed (mph measured 20 feet from the top of the vegetation) at which crown fire is expected to initiate. The torching index is a function of surface fuels characteristics, surface fuel moisture content, foliar moisture content, canopy base height, slope steepness, and wind reduction by the canopy. The higher the torching index, the better it meets the goal of reducing adverse effects from wildfires.
- Potential mortality (% basal area) is the potential tree mortality measured as a percent of the basal area that would be killed under selected weather conditions (i.e., August for this exercise). The lower the potential mortality, the better it meets the goal of reducing adverse effects from wildfires.
- Fire type is the type of fire under August weather conditions. Definitions of fire types come from the National Wildfire Coordinating Group (NWCG) Glossary of Wildland Fire Terminology, and include surface, passive crown fire, and active crown fire (Table 10). Numerical fire type is an output of FFE-FVS and is based on vegetation density and is a good indicator of the effectiveness of fuel treatments.

Table 10. Fire Type Values and Interpretation

	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	Moderate	2 -2.99	A fire in the crowns of trees with occasional torching of single trees and small groups of

	Fire Type	Values	Interpretation
Fire			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.

The FFE-FVS simulations show pile burn treatments in CT units as the initial treatment, (project implementation start) which would occur after 2016. The actual thinning would occur 1-2 years prior to the burning of hand piles. Short term (1-2 years) in between thinning and burning the piles fire behavior is still not at overall desired conditions, but expected fire behavior overall is still less than existing conditions or No action.

The FFE-FVS simulations show flame lengths that would be the result from the type of fire. Passive crown fires have occasional torching, which results in higher flame lengths than a surface fire. Active crown fires would generally have the highest flame lengths. FFE outputs for existing conditions of the CT units are predicted (based on flame lengths) as having active crown fire behavior. Fire behavior would be reduced to surface fire under the proposed action, and model outputs show that they achieve the desired future condition of reducing crown fire potential.

Torching Index is an element associated with the units based on topography and slope position; proposed treatments would increase the Torching Index up to 360% (see Figure 4 in Fuels Specialist Report). The higher the torching index (which is the wind speed needed to initiate crown fires), the more effective the fuel reduction treatment on surface and ladder fuels. The large increase in Torching Index indicates that surface fuels and small ladder fuels have been reduced to result in the desired condition of this project. The increase in crown base height (in general from 24 to 40 feet), also indicates that the shorter ladder fuels would have been treated effectively. The goal of treatments is to create a torching index that is greater than the typical August wind speeds.

Table 11 summarizes the pre-treatment (No Action) and post-treatment (Proposed Action) predicted fire behavior elements for the commercial treatment units.

Table 11. Average Fire Behavior Predictions for Commercial Harvest Units

	Flame Length (ft)	Torching Index (mi/hr)	Potential Mortality (% basal area)
Existing Conditions Untreated CH Units	6.7	30	68%
Desired Conditions Post Treatment	4.5	235	11%

TSI /Activity Fuel Treatment (TSI Units)

Fuels information collected included fuel models and stand characteristics. Fire behavior was modeled using the BehavePlus 5.0 program. Fire behavior modeling in the TSI units with activity fuel treatment of hand pile and burn (69%-100% of the TSI acres) shows a reduction in crown fire potential. Fire behavior potential in the units with masticated fuel beds, are also reduced. Mastication may occur on approximately 253 acres of the 801-TSI acre treatment acres. Fire behavior in units treated by mastication is expected to be similar to fire behavior predictions of post treatment thinning in units.

Fuel Reduction Treatment (F Units)

Fire behavior was modeled using BehavePlus. Fire behavior post treatment was modeled as a surface fire with a <3 foot flame length (down from 10.1-foot flame length with no treatment). The fire type in the fuel reduction treatment units (excluding the grass model) is estimated to be crown fire under the No Action; and fire type post treatment is estimated as surface fire. Fire Line Intensity (FLI) could reach 872 Btu/ft/s (the amount of heat released per foot of fire front per second) with no treatment. According to Rothermel (1983) a FLI of >1,000 Btu/ft/s would result in crowning, spotting, probable major fire runs, and ineffective control efforts at the head of the fire. After fuels reduction treatments the FLI is projected to be 44 Btu/ft/s which equates to fires that could generally be attacked at the head or flanks by persons using hand tools and hand fireline construction, effectively holding a fire (see Table 12).

Using 10-year out modeling predictions, fire behavior transitions back to existing conditions (crown fire) based on anticipated re-growth of the shrub species without maintenance. Refer to Figure 3 in the fuels report for more details on projected re-growth.

Table 12. Fire Suppression Interpretations of Flame Length and Fireline Intensity*

Flame Length (ft)	Fireline Intensity (Btu/ft/sec)	Interpretations
< 4	<100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.

Flame Length (ft)	Fireline Intensity (Btu/ft/sec)	Interpretations
4-8	100-500	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8-11	500-1,000	Fires may present serious control problems- torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
>11	>1,000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

*Adapted from Rothermel et al, 1983.

Fuel modeling for timber stand improvement (TSI) and fuel reduction treatments were determined by using Scott and Burgan (2005). Fuel models are used to characterize the fuel loading and representative fuel type in an area.

Representative fuel models were used to predict Fire Line Intensity, Flame Length, and Rate of Spread for both pre-and post-treatment units. Existing conditions or untreated conditions are based on three different fuel models (TU5, TU4, and SH7). Desired conditions or treated conditions are based on two different fuel models (TU1, and SH2). Short term (1-2 years) in between thinning and burning the piles fire behavior is expected to be represented by fuel model SB2.

- **TU5** - The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory. Spread rate is moderate; flame length moderate.
- **TU4-**The Primary carrier of fire in TU4 is short conifer trees with grass or moss understory. Spread rate is moderate; flame length moderate.
- **TU1** - The primary carrier of fire in TU1 is low load of grass and/or shrub with litter. Spread rate is low; flame length low.
- **SH7** - The primary carrier of fire in SH7 is woody shrubs and shrub litter. Very heavy shrub load, depth 4 to 6 feet. Spread rate lower than SH7, but flame length similar. Spread rate is high; flame length very high
- **SH2** - The primary carrier of fire in SH2 is woody shrubs and shrub litter. Moderate fuel load (higher than SH1), depth about 1 foot, and no grass fuel present. Spread rate is low; flame length low.
- **SB2** - The primary carrier of fire in SB2 is moderate dead and down activity fuel or light blowdown. Fine fuel load is 7 to 12 t/ac, evenly distributed across 0 to 0.25, 0.25 to 1, and 1 to 3 inch diameter classes, depth is about 1 foot. Blowdown is scattered, with many trees still standing. Spread rate is moderate; flame length moderate.

The following table summarizes fire behavior predictions (using Behave Plus) for TSI and fuel reduction units. The 97th percentile weather data was utilized for the following.

Table 13. Estimated Fuel and Fire Behavior Comparison of Alternatives 1 and 2

	Fuel Models	Fire Line Intensity (Btu/ft/sec)	Flame Length (ft)	Rate of Spread (ch/hr)
Timber Stand Improvement Units				
Existing Conditions Untreated TSI Units	TU5	872	10.1	16.2
Post Treatment-After thinning	SB2	656	8.9	29.6
Desired Condition Post Treatment-After hand pile and burn	TU1	44	2.6	5.4
Timber Stand Improvement Units				
Existing Conditions Untreated TSI Units	SH7	2909	17.6	64.9
Post Treatment-After thinning/lop and scatter	SB2	656	8.9	29.6
Desired Conditions Post Treatment-After hand pile and burn	SH2	335	6.5	12.9
Fuels Reduction Units				
Existing Conditions Untreated Fuels Units	TU5	872	10.1	16.2
Post Treatment-After thinning	SB2	656	8.9	29.6

Desired Conditions Post Treatment-After hand pile and burn	TU1	44	2.6	5.4
Existing Conditions Untreated Fuels Units	TU4	533	8.1	23.3
Desired Conditions Post Treatment-After Hand Pile and Burn	TU1	44	2.6	5.4

Summary

In general, the goal is to create conditions for fire resilient/resistant forests. All fuel treatment units would have at least a first treatment of thinning low ladder fuels (brush, and saplings <8" DBH), piling of the cut material and handpiling of natural fuels. Some units would receive a follow-up treatment of understory burning. Torching index is one of the indicators of success of treatments. The higher the torching index (which is the wind speed needed to initiate crown fires), the more effective the fuel reduction treatment on surface and ladder fuels. Flame lengths are also an indicator. Modeling done with FFE-FVS and BehavePlus on sampled units indicates torching index would be increased (positive effect) and flame length would be reduced (positive effect).

Silviculture

Existing Condition

The following discussion regarding vegetation applies to upland sites as well as riparian reserves within the planning area. Vegetation found within riparian reserves often does not differ from areas outside riparian reserves. Proposed actions would incorporate commercial thinning and fuels treatments within the outer 80 foot portion of riparian reserves.

Influences on Existing Condition

Timber Harvest

The planning area was developed for timber production beginning in the early 1960s. Concerns over effects on soils from tractor logging lead to the introduction of cable logging systems. For economic reasons block clear cutting became the norm especially with cable systems which require a high volume of timber be yarded to each landing. Planting of bare root seedlings was begun in the early 1960s after it became clear that natural seeding was not providing adequate

stocking. At that time the development paradigm was to build the long-term road system necessary for access to timber stands through the creation of 20 to 40 acre clearcuts spaced out along the road system ("staggered-setting approach). This lead to the breaking up of larger areas of contiguous forest into patches of early- to late-mature forest with young stands interspersed throughout. Approximately 24,000 acres of regeneration harvest has occurred within the NRA, removing approximately 1 billion board feet (USDA 1992).

The Analysis of the Management Situation (AMS 1995) found that 11 percent of the Six Rivers NF had been regenerated by clearcut, shelterwood, and seed tree methods. Lands available for regulated timber harvest are the capable, available, and suitable lands, which comprise 9 percent of the Forest; 91 percent of the Forest is currently in reserves that do not allow scheduled timber harvest (1995 LRMP ROD-5).

Fire History

The fire regime within the planning area would generally be considered a low to moderate severity regime with infrequent periods of stand replacing fire during extended droughts (Jimerson et al. 1996). However, aboriginal burning was done frequently to maintain conditions favorable for tanoak acorn harvests and big game forage/browse, and these fires likely contributed to the hardwood dominance in many areas. Large stand-replacing fires in the early-1900s appear to be the event responsible for the origin of the stands within this project area.

Insects and Disease

The incidence of insects and disease within the project area is generally low and would be considered to be at endemic levels, with the exception of Port-Orford-cedar root disease. Dwarf mistletoe on Jeffrey pine is locally common, and it will be a major factor in understory development in the Jeffrey pine type.

Forest Composition/Series

The project area elevation varies from approximately 395 feet to approximately 4133 feet. Annual precipitation varies from 60 to 120 inches.

Vegetation within the planning area is heavily influenced by geology. The dominant potential and existing vegetation series on non-ultramafic derived soils are tanoak (57.4%) and Douglas-fir (17.3%). Existing vegetation series growing on ultramafic and serpentine derived soils are primarily western white pine (11.0%), lodge pole pine (5.2%), sugar pine (0.9%), knobcone pine (2.0%) and Jeffrey pine (2.0%).

Seral stage distribution within the planning area is heavily skewed towards early seral stands. Disturbance patterns and events determine the existing landscape. The current seral stage distribution within the planning area is: shrub dominated (4.0%), pole (14.6%), early mature (27.3%), mid-mature (28.8%), late mature (7.2%) and old growth (16.6%). At least 11% of the planning area has been harvested in the past. Almost 75% of harvested areas were from regeneration harvests (clear cuts).

The areas proposed for harvest are located within the tanoak series, where Douglas-fir is the major early seral tree species that establishes itself after a disturbance that removes most of the

forest canopy. Tanoak and giant chinquapin are common overstory associates and dominate understory regeneration. Typical understory vegetation consists of evergreen huckleberry, tanoak, rhododendron, salal, dwarf Oregon-grape, and madrone.

Timber stands are mainly dominated by relatively even-aged 70 to 80 year old Douglas-fir with varying amounts of sugar pine, tanoak, and chinquapin. These stands are thought to be the result of large stand-replacing fires during the early 1900s. Many stands appear to have a mosaic of several age classes in them indicating regeneration over several decades with past mixed-severity fires possibly contributing to this "patchiness". The amount of hardwoods in stands varies greatly; in some younger stands (EM2) tanoak and chinquapin are the dominant species, or are at least co-dominant with Douglas-fir.

Stands were grouped into four strata as follows (all references to age are for average breast height age of dominant trees):

1. PH (681 acres)- older plantations average about 45 years of age and have fairly uniform Douglas-fir, averaging about 10 inches diameter with dominant/co-dominant trees about 16 inches DBH. Younger plantation vary in age but generally have smaller conifers and contain higher number of hardwoods
2. EM1(218 acres)- fairly uniform natural stands of Douglas-fir about 80 years of age, averaging about 13 inches DBH with dominant/co-dominant trees about 20 inches DBH
3. EM2 (446 acres)- mixed natural stands of Douglas-fir, tanoak, chinquapin, and madrone about 70 years of age, averaging about 10 inches DBH with dominant/co-dominant trees about 13 inches DBH
4. MM (142 acres)- fairly uniform natural stands of Douglas-fir about 80 to 90 years of age, averaging about 13 inches DBH with dominant/co-dominant trees about 24 inches DBH

Forest Structure/Seral Stages/Density

Forest seral stages parallel stand development that corresponds to changes in stand structure (tree sizes/ages, species composition, and spatial distribution) over time. Seral stages can be thought of as a time sequence, although disturbances such as fire, wind, and disease can result in alterations to this sequence. The Six Rivers National Forest has grouped stands into six seral stages based on stand attributes and conditions. These stages are defined as follows:

- Shrub/Forb (S): Generally open to dense stands dominated by shrubs and/or grasses (depending on location within the zone) with the top layer of conifers smaller than 6" DBH (size class 0-1). Shrub/forb stands resulting from natural disturbances such as wildfire, mass soil movement, or flood are classified as shrub natural (SN); stands resulting from regeneration harvesting or salvage after a natural disturbance would be classified as shrub harvest (SH) or shrub salvage (SS).

- Pole (P): Generally dense single layer stands, dominated by trees with the top layer of conifers between 6" and 11" DBH (size class 2). Pole stands resulting from natural disturbances are classified as pole natural (PN); stands resulting from regeneration harvesting (i.e. 10 to 30 year old plantations) or natural pole stands that have been thinned are classified as pole harvest (PH).

- Early Mature (EM): Generally dense, closed canopy, single layer stands dominated by trees with the top layer of conifers between 11" and 21" DBH (size class 3). Early mature stands may further characterized by the presence of large scattered predominant conifers generally greater than 36" DBH (size class 5) in the overstory (EA), evidence of past harvest such as thinning or individual tree selection (EH), or both the presence of large scattered predominant conifers and past harvest (EB).
- Mid Mature (MM): Generally dense closed canopy stands, with one or two layers dominated by trees with the top layer of conifers between 18" and 30" DBH (size classes 3 and 4; 11"- 21" and 21"- 36" DBH). As with early mature stands, the mid mature seral stage can also be further categorized as MA, MH, or MB.
- Late Mature (LM): Generally dense, closed canopy stands, with two or more layers present, dominated by tree with the top layer of conifers 30" DBH or larger (size classes 4 and 5; 21"-36" and ≥ 36" DBH). Late mature with evidence of past harvest is classified as late harvest (LH).
- Old Growth (OG): Generally open to dense stands, with multiple layers and trees of various size classes, the top layer of which is generally larger than 30" DBH (size classes 4 and 5). Old growth with evidence of past harvest is classified as old growth harvest (OH).

These early- and mid-mature even-aged stands in the project area are in a stage of development classified as the "stem exclusion" stage according to Oliver and Larson (1990). In this stage, the trees have re-occupied all growing space and exclude new plants from becoming established. Variations in height growth have occurred to various degrees, with some trees expressing "dominance" over other to the point that many are overtopped and receiving no direct sunlight.

In order to better describe the stands in the project area, they were stratified by seral stage (see Methodology for Analysis, above). This resulted in four strata, which are presented in Table 14 along with their descriptive metrics.

Table 14. Stratification of project area

Stratum	Age	Breast Height Ave. DBH	Canopy Cover	Trees/Acre	BA/Acre	SDI	% Max SDI
EM1	79	13.3	76	376	255	449	82%
EM2	72	10.0	71	459	165	341	62%
MM	80	13.3	73	366	245	428	78%
PH	46	10.2	82	656	256	507	93%

Stand density in all strata, based on average stand density index (SDI) (Table 16) is currently at the point where inter-tree competition can be expected to lead to suppression-related mortality, and in fact this mortality has been noted in several stands. The desired SDI range for this forest type is 35 to 50 percent of maximum SDI. Basal area density measures are higher than recommended stocking levels for optimizing individual tree and stand growth (Table 16). These higher stand densities indicate that stand vigor and growth is declining. Desired basal area per

acre is based on maintaining stands within the ranges are displayed in Table 16, while providing for within stand variation through variable-density thinning methods.

Changes from Historic Conditions

Disturbance Processes and Patterns

Wildfire

The absence of recent mixed-severity fire has been a likely factor in the rather uniform, even-aged, single-layer structure of these stands. Fire suppression since the early 1900s means that these sites have likely missed several fire events that would have created more horizontal and structural diversity in the early- and mid-mature stands (Weisberg 2004, Taylor and Skinner 2003).

Stand structure and fuel arrangement is now such that stand-replacing fire would be expected to be a substantial, if not the dominant, type of fire severity during wildfires in the project area. This condition differs from a mixed-severity regime, where fire would have multiple effects ranging from non-lethal surface fire to creation of small patches of high mortality that would lead to regeneration of early seral species. In the mixed-mortality areas, stand thinning by fire would typically have led to the creation of two-layered stands by creating conditions favorable to the establishment of early seral species in the understory.

Timber Harvest

Previous timber harvest focused on removal of the larger, most fire resistant trees in selective and clearcut harvest areas. Large predominant trees were selectively removed without thinning the remainder of the stand, which has created fuel conditions conducive to crown fire. Many plantations previously established after regeneration harvest have now reached the pole stage and are dense and very susceptible to damage from both surface and crown fire.

Tree Mortality/Snags

Dead trees in the project area are generally small diameter (less than 20 inches DBH), without the large snags found in older stands. Mortality from competition, white pine blister rust in sugar pine, and physical damage is variable and current snag densities are variable. Current snag densities within the project area are given in Table 15. Downed wood data was similar to the snag population in that it is composed of small logs from competition-related mortality and with pine blister rust, and large logs in an advanced state of decay.

Table 15 Estimated snag densities (per acre) within thinning units by stratum

Stratum	Total Snags >=10 in.	Snags >=20 in.	Snags 10-19 in.
EM1	8.9	1.0	7.9
EM2	10.6	0.6	10.0

Stratum	Total Snags >=10 in.	Snags >=20 in.	Snags 10-19 in.
MM	10.8	0.9	9.9
PH	0.9	0.4	0.5

Desired Condition

Baseline/Reference Conditions

One of the objectives of this project is to stimulate development of late-successional elements in young Douglas-fir stands, in the long-term creating a structure that is similar to old-growth reference conditions, and containing the critical habitat elements for late-successional dependent species. Using this approach on all lands would allow the Forest to meet the RMR for late-mature/old-growth sooner and lead to flexibility in management in the future. Late-successional elements in the Klamath/Coast Mountains Provinces focuses on structural diversity, which includes the following (Carey et al. 1999):

1. Diversity of tree sizes
2. Horizontal patchiness (gaps, high stem densities)
3. Vertical diversity (continuous canopy from tree tops to ground, but not everywhere in stand) with presence of shade-tolerant hardwoods and development of epicormic branching in Douglas-fir in open parts of stand
4. Abundant cavity trees (snags, decadent trees)
5. Appropriate coarse woody debris

Resiliency to Fire and other Disturbances

Horizontal variation in stand density, retention of a hardwood component, and reduction of small understory trees would reduce crown fire potential in stands. Improvements in live crown ratios would eventually lead to more favorable height-to-diameter ratios, which would reduce the potential for stand breakage from winter storms. Initially, the potential for wind-throw would increase, but over the long term the stand would be more wind-firm as individual trees occupy the increased rooting space created through thinning.

Healthy/Sustainable Forest Density and Structure

According to Long (1985), density management is the manipulation and control of growing stock to achieve specific management objectives. Stand density index (SDI) was used to develop guidelines for maintaining stand density within a range where the individual tree growth rates would be optimized, and mortality would be reduced. Table 16 is a density management regime based on maintaining the stand between 35 percent of maximum SDI (approximate onset of inter-tree competition) and 50 percent of maximum SDI (zone below onset of competition induced mortality (Long 1985).

Table 16- Density management regime for Douglas-fir in NW Calif.

Mean DBH	LMZ-SDI	UMZ-SDI	TPA LMZ	TPA UMZ	BA/A LMZ	BA/A UMZ
4	**191**	**274**	764	1091	67	95
6	**191**	**274**	414	591	81	116
8	**191**	**274**	268	383	94	134
10	**191**	**274**	191	274	104	149
12	**191**	**274**	145	208	114	163
14	**191**	**274**	115	165	123	176
16	**191**	**274**	94	135	131	188
18	**191**	**274**	79	113	139	199
20	**191**	**274**	67	96	147	209
22	**191**	**274**	58	83	154	220
24	**191**	**274**	51	73	160	229
26	**191**	**274**	45	65	167	238
28	**191**	**274**	40	58	173	247
30	**191**	**274**	36	52	179	256

Notes: Max. SDI equals 547 (Douglas-fir, FVS); Lower management zone (LMZ) = 35% max. SDI; Upper management zone (UMZ) = 50% of max. SDI

Existing density within early- and mid-mature stands and plantations are not desired in the long-term (see Table 14). Thinning is needed to improve growth, enhance stand health, and reduce potential mortality within these stands. Thinning these stands would not compromise long-term growth and yield at the stand or watershed level, since Douglas-fir has been shown to respond to thinning at all ages. Maintaining density between 35 and 50 percent of maximum is thought to be appropriate in this area given the significant component of tolerant hardwood tree and shrub species that are prolific at sprouting; canopy density would be maintained between approximately 40 and 60 percent which would reduce the site occupancy of these understory species.

Late-Successional Forest

Research (Carey et al. 1999, Wilson and Puettmann 2007, Bailey and Tappeiner 1998) has identified the need and/or opportunity for silvicultural treatments in younger stands to accelerate the development of late-successional forest characteristics. This situation may be especially pertinent in forests that previously developed under a mixed-severity fire regime (Weisberg 2004). Carrying out these types of treatments here in early- and mid-mature stands would increase future management options at the landscape level by improving stand health and resiliency, and by “pushing” stands towards the late-mature seral stage.

Desired conditions for late-successional forest characteristics include the development of large trees, multi-storied canopies, horizontal patchiness, and species diversification. The stocking levels and structure of these stands exhibit symptoms that in many instances could delay the development of late-successional forest characteristics for many decades. Thinning treatments could ensure the health and improve the growth of these stands, diversify the stand structure, and accelerate the development of late-successional forest characteristics.

The outer portion of riparian reserves (outer 80 feet) would be thinned under the proposed action. Commercial thinning of plantations and early- and even-aged mid-mature stands in riparian reserves, which are the same types of stands as found outside of the reserves, would be beneficial to the riparian reserve where the objectives are to increase the average diameter of the stand, and/or accelerate the development of large conifers and shade tolerant shrubs. Accelerating the diameter growth of riparian reserve stands will assist in creation of late-successional conditions sooner, maintain stand health and reduce potential for stand-replacing fires, as well as providing for faster development of large woody material sources for in-stream and terrestrial habitat. The stands proposed for thinning are structurally simple, have a single canopy layer, are limited in number of tree species, have relatively little understory, and in some cases, have few standing or fallen dead trees. Thinning can move stands out of the dense, closed-canopy stage and accelerate the development of conditions found in late seral forests. Thinning can also encourage survival of suppressed and intermediate trees and promote growth of the remaining trees, resulting in a more diverse forest structure. Therefore, the objectives of riparian reserves can be met sooner, than if no thinning occurred. Thinning would also promote the re-introduction of fire as an ecological process into these areas which have the same mixed-severity fire regime as the surrounding forest.

The Purpose and Need objectives drove the identification of treatment areas for the strategically placed shaded fuelbreaks within the WUI and young even-aged stands (natural stands and plantations) needing treatment within the LSR.

In addition to accomplishing the project's Purpose and Need, the proposed action offers opportunities to provide by-product commodities.

Comparison of Alternatives

Alternative 1 – No Action

Direct Effects

There would be no direct effects to vegetation and fuels from the selection of the no action alternative because no treatments would occur.

Indirect Effects

Indirect effects of the no action alternative to vegetation and fuels would occur as these young stands remain growing at their current high densities. As noted above (see Table 16), stand density indicates that competition-related mortality is expected to increase as resources on the site become limiting. The current density also has led to susceptibility to physical damage from

winter storms, and this effect has been noted in some stands. These two factors in combination have the potential to lead to the development of high fuel loadings, increasing the hazard of stand-replacing fires, which would further exacerbate the age-class/seral stage gap in the project area with the loss of up to 80 years of growth in these stands.

Without treatment now, many of these stands would likely eventually develop into the desired structure as natural disturbances and competition-related mortality open up the stand and trigger the understory re-initiation stage of development. However, it is expected that this process would take substantially longer than under the proposed thinning regimes (Bailey and Tappeiner 1998). Thinning now would also broaden future management options by removing hazardous fuels and creating stands more resilient to weather disturbances.

No action would forgo the opportunity to harvest approximately 4.0 million board feet of timber and 17,900 BDT of biomass that would be produced from activity-generated materials. A large portion of this timber would be in the form of trees that would die in the future from inter-tree competition.

Without the additional treatment of fuels corridors suppression forces would have fewer options for safe access and containment strategies based on fuel breaks. The ability to use the thinned and treated areas as anchor points for containment would be compromised.

Alternative 2 – Proposed Action

Choice of Silvicultural Prescription

The Proposed Action would employ variable density, thinning from below (low thinning) (Tappeiner et al 2007) in early- (710 acres) and early/mid-mature (142 acres) Douglas-fir/hardwood stands ranging in age from 70 to 80 years, and Douglas-fir – hardwood plantations (634 acres). These stands are generally single-layered and consist of even-aged patches of varying age. A positive response to thinning is expected since subordinate trees could be removed to allow trees of the upper canopy (which have more fully developed crowns) to utilize the additional growing space. Reducing stand density at this time would allow these stands to quickly develop more resilience to disturbances such as wind, heavy snow and ice, bark beetles, and fire.

Thinning from below is a treatment in even-aged stands that would also produce commercial types and quantities of timber to meet the stated purpose and need for timber production within the planning areas of the project. Some of these early- and mid-mature stands could already qualify for regeneration harvest based on having reached 95 percent of the culmination of mean annual increment (CMAI). However, thinning these stands would not compromise long-term growth and yield at the stand or watershed level (Curtis 1997, Tappeiner et al 2007), since high growth rates could be maintained and thinning from below would delay or extend CMAI, and Douglas-fir has been shown to respond to thinning even as old-growth trees (Latham and Tappeiner 2002). Thinning from below would maintain all future management options within the planning area, including regeneration harvest in the stands thinned in this entry.

Units chosen for this alternative were located outside of NSO-nesting/roosting habitat.

Three plantations within the NRA Prescribed Timber Management Zone (units 23, 26 and 207) would involve thinning of second-growth redwood and Douglas-fir. The stands originated after

clearcutting in the mid-1960s by planting of Douglas-fir and stump-sprouting of the redwood. Composition is currently about 50 percent redwood and 50 percent Douglas-fir. Objectives of the thinning are to increase the proportion of redwood in the stand by favoring it over Douglas-fir, thin clumps of redwoods to increase growth and favor development of very large trees, and promote the development of hardwoods in the understory. These treatments are expected to promote the development of late-successional redwood stand structure sooner than would occur with no action.

Two previously managed stands within the LSR would be tsi/hardwood restoration. These stands are along pre-existing routes, near the tops of ridges or upper 1/3 slopes. Two units (244 and 246) have been previously logged in the 1960's. They are currently dominated by densely growing hardwoods.

In unit 244 (10 acres), large sugar pine had been high-graded in the mid 1960s. The majority of the stand now consists of hardwoods, primarily chinquapin and tanoak (510 trees/acre), the largest which average 8" - 12" DBH. Sugar pine is the dominant overstory conifer (32 trees/acre), the average size around 10" DBH, though larger trees occur throughout the stand, some as large as 32". Douglas-fir is the dominant conifer in the regeneration layer (143 treees/acre, < 6" DBH).

Unit 246 (6 acres) is a result of a stand replacing fire that occurred in the 1960's, followed by salvage logging. The stand is now dominated by tanoak, the largest averaging 8" – 10" DBH tanoak (624 trees/acre), along with scattered 12" – 16" DBH Douglas-fir in the overstory (40 trees/acre).

Silvicultural Treatments/Logging Systems/Temporary Roads

Approximately 1466 acres would be thinned under a low thinning silvicultural prescription. Units proposed for thinning are in the tanoak series. Seral stages range from plantations to early- to mid- mature.

Commercial thinning and TSI in the outer half of riparian reserves would be included with the objectives of increasing the average diameter of the stand, and/or accelerate the development of the shade tolerant understory. As with upland sites, thinning would remove the smaller diameter trees and leave hardwoods, and would take place in plantations, early- and mid-mature stands. Thinning would be a lighter intensity, designed to leave approximately 60 percent canopy cover (40% in plantations). No equipment would be allowed within the riparian reserve- logs would be winched to equipment located on roads or skid trails outside of the riparian reserve.

The Proposed Action employs primarily ground-based logging systems on commercial treatments. Ground-based systems would be used to skid logs on slopes up to 35 percent using either tracked or rubber-tired skidders. Skyline/cable yarding systems on commercial treatments would be used on steeper ground (slopes greater than 35 percent) on approximately 141 acres.

Table 17- Proposed Action summary by Prescription, Logging System, and Products

Rx	Logging system	acres	Total mbf	Total tons (bone dry)
CT	G	524	3000	6069
CT	S-MY	141	1000	2511
Totals		**665**	**4000**	**8580**

The Proposed Action would construct approximately 0.26 miles of new temporary roads and utilize approximately 2.8 miles of existing temporary road. New temporary roads would be located and constructed to minimize ground disturbance, protect resources, and provide safe transportation at the least possible cost. Existing non-system roads are temporary roads constructed for past harvest activities. These roads require re-opening and blading prior to use. Road reconstruction, as defined by Forest Service Manual 7700, would not be required.

All new temporary roads and existing tempary roads used for this project would be decommissioned upon project completion to reduce actual and potential sediment generated from these roads. Decommissioning would generally involve one or more of the following activities: 1) sub-soiling or out-sloping the road surface; 2) removing drainage structures; 3) installing water bars; 4) mulching with native materials (logging slash) or certified weed free straw; and 5) placing earth or log mound barriers to prevent vehicle traffic.

Landing and temporary road locations shown on the project planning maps and GIS layers are the best estimate of the actual facilities that would be needed to log the proposed units, based on intensive field reconnaissance. Actual locations for new landings and temporary roads may vary slightly, and are subject to agreement by the Forest Service and timber purchaser under the Timber Sale Contract or other agreements. All landings and temporary roads would comply with BMPs and project design features. Existing landings and skid trails would be used to the fullest extent possible. New landings may be constructed where necessary to facilitate logging operations. New and existing landings would be located either within, or adjacent to, treatment units. New landings would be outside of riparian reserves, and use of existing landings would be confined to those located at least 100 feet from stream channels.

Small inclusions within skyline units which are suitable for ground-based logging systems would be logged using ground-based equipment where feasible. These areas are typically along existing roads on ridge tops or benches adjacent to slope breaks into steeper topography, and are generally less than five acres in size. Project implementation activities, including the logging feasibility report, unit layout, and sale administration will identify these areas.

Harvest Activity Fuel/Hazardous Fuel Treatments

Fuel treatments in timber harvest units would focus on the treatment of activity fuels, primarily through yarding of tops to landings for disposal by burning or chipping. However, it is also anticipated that follow up treatments using grapple piling from roads may be needed to deal with fuel loading from stem breakage and de-limbing operations.

Recommended Management Range (RMR)

The proposed action differs from past actions, in that previous timber harvest (with the exception of some recent commercial thinnings) consisted of clearcut logging, broadcast burning, and planting with Douglas-fir seedlings. The actions proposed here are intermediate treatments that have the express intent of maintaining all management options for the future and of stimulating the development of late-successional forest conditions that are currently lacking on the landscape. These treatments would move these stands along the pathway to mid-mature/late-mature and understory re-initiation, but would not alter the current distribution of seral or development stages (also called structural stages) within the analysis area.

There would be no direct effects of the proposed action on the current seral stage distribution for the planning area. Over time (10-20 years) the early- and mid-mature stands thinned in this project would have started to develop larger average tree sizes, longer and wider crowns, more vertical structure and understory diversity, and more healthy hardwoods. These effects would lead to higher percentages for the mid- and late-mature stages than at present.

Forest Health/Resiliency to Disturbance

The thinning treatments under both action alternatives would reduce canopy bulk density, raise the canopy base height, and increase average stand diameters. In terms of fire resiliency, all of these factors would make these stands more able to withstand the effects of a fire (Graham et al. 1999). While there are always tradeoffs to stand manipulations in terms of fire behavior, it is expected that in the long term (10 years and beyond) the thinning conducted in this project would lead to reduced propensity towards crown fires and stand-replacing fire events. This conclusion is based on the expected rapid recovery of the upper canopy that would inhibit continued growth of tall shrubs that could contribute to extreme fire behavior. Opening up these stands would increase potential wind speeds in the short term, which contribute to flame lengths, but this effect should be negated by the reductions in surface and canopy fuels (Graham et al. 2004, Agee and Skinner 2005).

Thinning would improve the ability of these stands to withstand the typical winter wind, and snow storms in the Coast Ranges and Klamath Mountains, although there may be a short-term increase in susceptibility to wind storms in the denser stands on exposed sites. Over time, thinning promotes a lower height-to-diameter ratio which improves the ability of a tree to withstand heavy snow and ice loads, especially if they are associated with dynamic loadings associated with high winds (Oliver and Larson 1990). Care was taken to design thinning intensity so that stands exposed to prevailing winds would not be opened up too fast too soon. However, some blow-down is still to be expected, and these events are expected to provide additional coarse woody debris and diversity to stands, while still maintaining an adequate growing stock for future management objectives, including wildlife habitat.

Riparian Reserves

Commercial thinning of young stands in the outer portion of riparian reserves would be

beneficial to the riparian reserves in that the objectives are to increase the average diameter of the stand, and accelerate the development of the shade tolerant understory. The stands on these sites do not differ from the surrounding unit, so the aforementioned effects apply to these areas as well. Accelerating the diameter growth of riparian stands will assist in creation of late-successional conditions sooner and provide for a faster development of large woody material sources for in-stream and terrestrial habitat. Another benefit would be to reduce the potential of untreated riparian reserves in contributing to growth of large fires, as well as reducing potential effects from moderate to severe burning on soil structure and erosion.

Cumulative Effects of Each Alternative

Alternative 1 – No Action

Within the planning area, timber harvest and associated road construction and fire suppression have been the dominant management activities having a cumulative effect on vegetation. Regeneration harvest using the clearcut or clearcut with reserve trees systems has affected the distribution of seral stages, which currently are below the RMR for the old-growth stage. The no action alternative would have no effect on the current distribution of these stages in the next 30 years. After 30 years, it is expected that many of the mid-mature stands would begin to move into the late-mature stage (understory re-initiation) as a result of inter-tree competition –based mortality and natural disturbances.

Alternative 2 –Proposed Action

Past Actions and their Effect on Current Conditions

As mentioned above under Existing Condition, past timber harvest in the Smith River NRA has resulted in an altered distribution of seral stages compared to 60 years ago, when active timber harvest began.

Contrasting Effects of Proposed Action with Past Actions

The proposed action differs from past actions, in that historic timber harvest (pre-1990's) consisted of clearcut or shelterwood logging, broadcast burning, and planting with Douglas-fir seedlings. The actions proposed here are intermediate treatments that have the express intent of maintaining all management options for the future and of stimulating the development of old-growth forest conditions that are currently lacking on the landscape. These treatments would move these stands along the pathway to mid-mature/late-mature and understory re-initiation, but would not alter the current distribution of seral or development stages (also called structural stages) within the analysis area.

Effects of Ongoing and Reasonably Foreseeable Actions

Similar thinning projects are being carried out within this watershed. The Big Flat Timber Sale has been recently implemented. Other foreseeable actions within the analysis area are precommercial thinning in plantations in the stand initiation stage (pole harvest), having the objective of moving these stands more rapidly along the successional pathway towards older forest structure without changing the current distribution of stages.

Combined Effects from Past, Proposed, Ongoing and Foreseeable Actions

In terms of past, proposed, ongoing, and foreseeable actions, this project would have no cumulative effects to the vegetation structural stages within the NRA. The current distribution has been molded by past activities, which removed older forest types, and by past wildfires. This project would improve the distribution of structural stages over the long-term for species needing older forest habitat for part or all of their life cycle.

Geology

Geologic Setting

The Gordon Hill project area occupies a montane upland area of the western Klamath Mountains geologic province. The Klamath Mountains consist of a number of accreted terranes of Paleozoic and Mesozoic age intruded by plutonic igneous rocks both during and following accretion to the North American continent. The project area is wholly within the Smith subterrane of the Western Klamath terrane, the westernmost of the Klamath accreted terranes. Ultramafic rocks of the Josephine Ophiolite predominate, with lesser proportions of associated intrusive rocks and of Galice Formation metasediments. Cycles of erosion, uplift, and incision have formed the modern landscape of the assessment area. Gentle upland topography relict of an ancient erosional surface is preserved on concordant ridge tops. The steep mountainsides and deep narrow canyons that characterize the landscape are the topographic expression of relatively recent tectonic uplift. Mass wasting processes are most active in inner gorge and lower hillslope settings, chiefly shallow debris slides, although some active and dormant slump-earthflows and other deep-seated landslides are present under forest canopy. Bedrock geology and hillslope position determine a mosaic of vegetation types, with ultramafic lithology in upper hillslope positions representing the least productive sites and supporting unique serpentinite-endemic vegetation.

Landscape Setting and Evolution

The topography of the assessment area consists of a series of narrow linear ridges and valleys of generally E-W to NE-SW orientation, with gently convex concordant ridge tops whose elevations increase from west to east, from roughly 2,000 feet in the western portion of the area to 4,157 feet on Gordon Mountain in the northeast. The base elevation of the area, at the confluence of the South Fork and mainstem Smith River, is approximately 160 feet mean sea level. Steep narrow canyons predominate, although there is an area of broader, gentler topography in the area of Lower Coon Mountain in the west-central portion of the area. Deep dissection of a former upland surface produced this topography. This surface has been dubbed the “Klamath peneplain” by some (Maxson 1933, Aalto 2006, Anderson 2008), after Diller (1902). It likely represents a late Cenozoic planation to sea level prior to uplift. The landscape is the westernmost extent of the Klamath Mountains geologic province in its closest proximity to the Pacific coast. Uplift of these ranges was likely associated with tectonic forces of convergence related to accretion and subduction, most recently during the ongoing Cascadia subduction event.

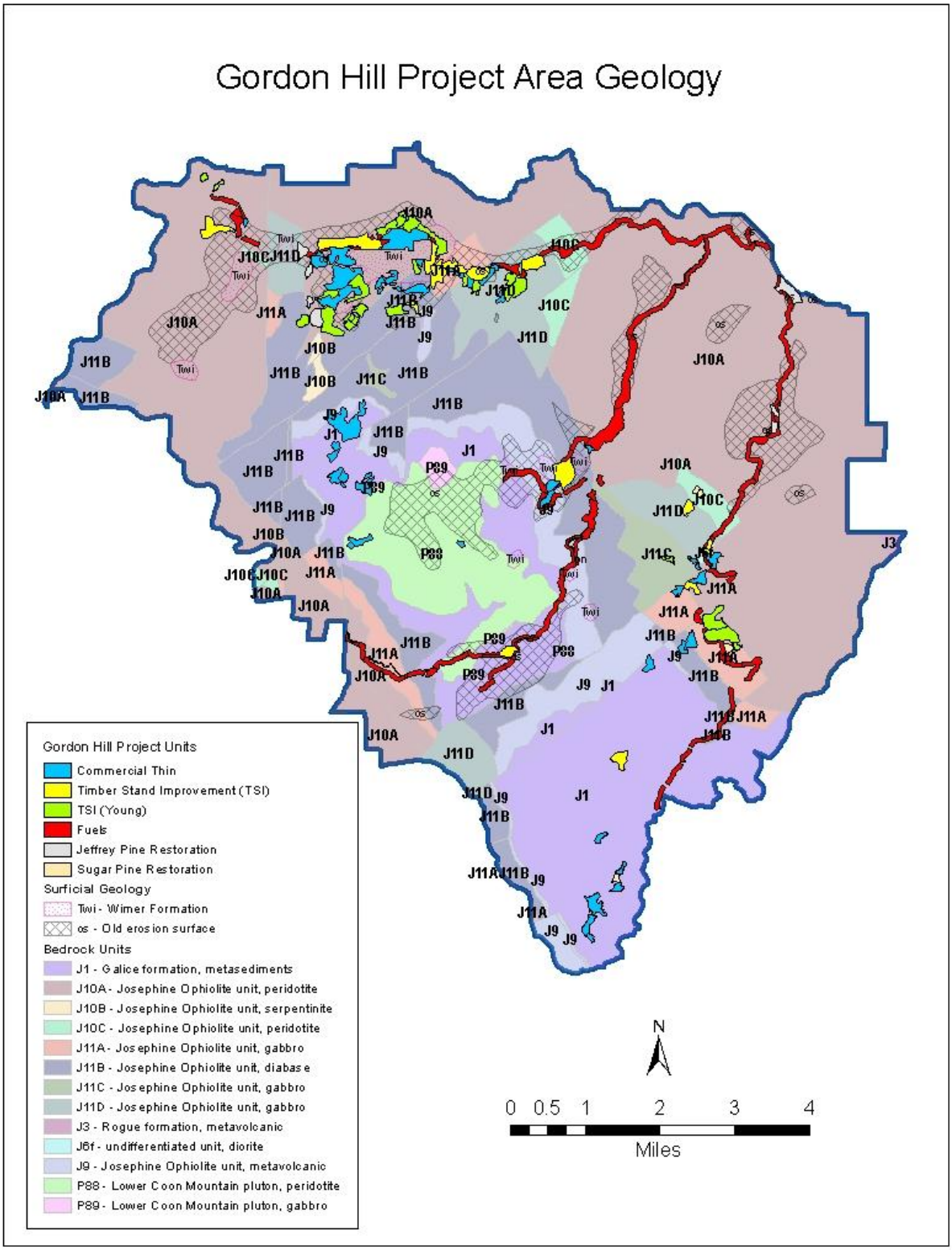


Figure 1. Gordon Hill Project Area Bedrock and Surficial Geology, with Gordon Hill project units.

Bedrock Geology

The project area is underlain by accreted lithologies belonging to the Western Klamath terrane of the Klamath Mountains geologic province (Irwin, 1994). Within the project area, this westernmost belt of Klamath Mountain rocks is included in the Smith subterrane (Silberling et al 1992), consisting dominantly of the Josephine Ophiolite sequence and overlying metasedimentary package characterized as Galice Formation or a close correlate. The Josephine Ophiolite represents an intact sequence of mantle rocks and seafloor emplaced on North America during a late Jurassic subduction event identified with the Nevadan orogeny (Harper 1980, Harper et al 1994). The Josephine Ophiolite is unique in that it represents one of the largest terrestrial exposures of peridotite ultramafic rocks. Figure 1 displays the distribution of bedrock geologic map units within the project area. For detailed descriptions and interpretations, see the Gordon Hill Geology Report in the project record.

Surficial Geology

Two surficial geologic map units are described in the project area, relevant to landscape evolution and geomorphic processes that affect forest ecology and management. These are the Old Erosion Surface and the Wimer Formation (Figure 1). Both are associated with the "Klamath peneplain", a remnant erosional surface preserved in ridgetop positions in the project area. The Old Erosion Surface, a relict erosion surface that occupies planar to broadly convex concordant ridgetops in the area, is a common feature in the Klamath Mountains. It is best developed in the vicinity of the project area. The Wimer Formation is a late Cenozoic shoreline depositional sequence that is fossiliferous, occupying portions of the Old Erosional Surface in the western portions of the project area.

Geomorphic Processes and Landforms

The project area encompasses a variety of landforms characteristic of the Klamath Mountains province and specific to the tectonic history and geologic setting of northwesternmost California. Rapid Late Tertiary uplift of the Miocene littoral zone and coastal plain, and subsequent deep incision under wet Pacific climatic conditions, have resulted in the existing landscape of high relief, subparallel to trellis drainage patterns, linear ridges with gentle, broadly convex crests, and steep stream gradients. Deep-seated landslides that largely initiated under wetter Pleistocene climates mantle much of the landscape (Figure 2). Most of these older features are presently dormant, although some recently active deep-seated slide activity has been noted in the project area. Shallow rapid landslides are also common, although many are also relict features that failed prehistorically and have little contemporary activity or failure potential. Recent shallow rapid landslides are relatively common, generally on steep slopes in inner gorge and lower hillslope positions. Inner gorge landforms, formed as recent tectonic uplift has driven incision and formed coalescing debris slides on oversteepened streamside canyon slopes (Kelsey, 1988), are present in most higher-order stream channels in the project area (Figure 2).The majority of recent active landslides were initiated either prior to 1944 (the earliest aerial photographic record of the area), or as a consequence of the 1964 storm/flood event which is the flood of record in the area. Many of these have regained vegetative cover in the intervening nearly half-century, and are no longer chronic sediment sources. A few currently active landslides were discovered and/or evaluated during fieldwork for the Gordon Hill project, as described below.

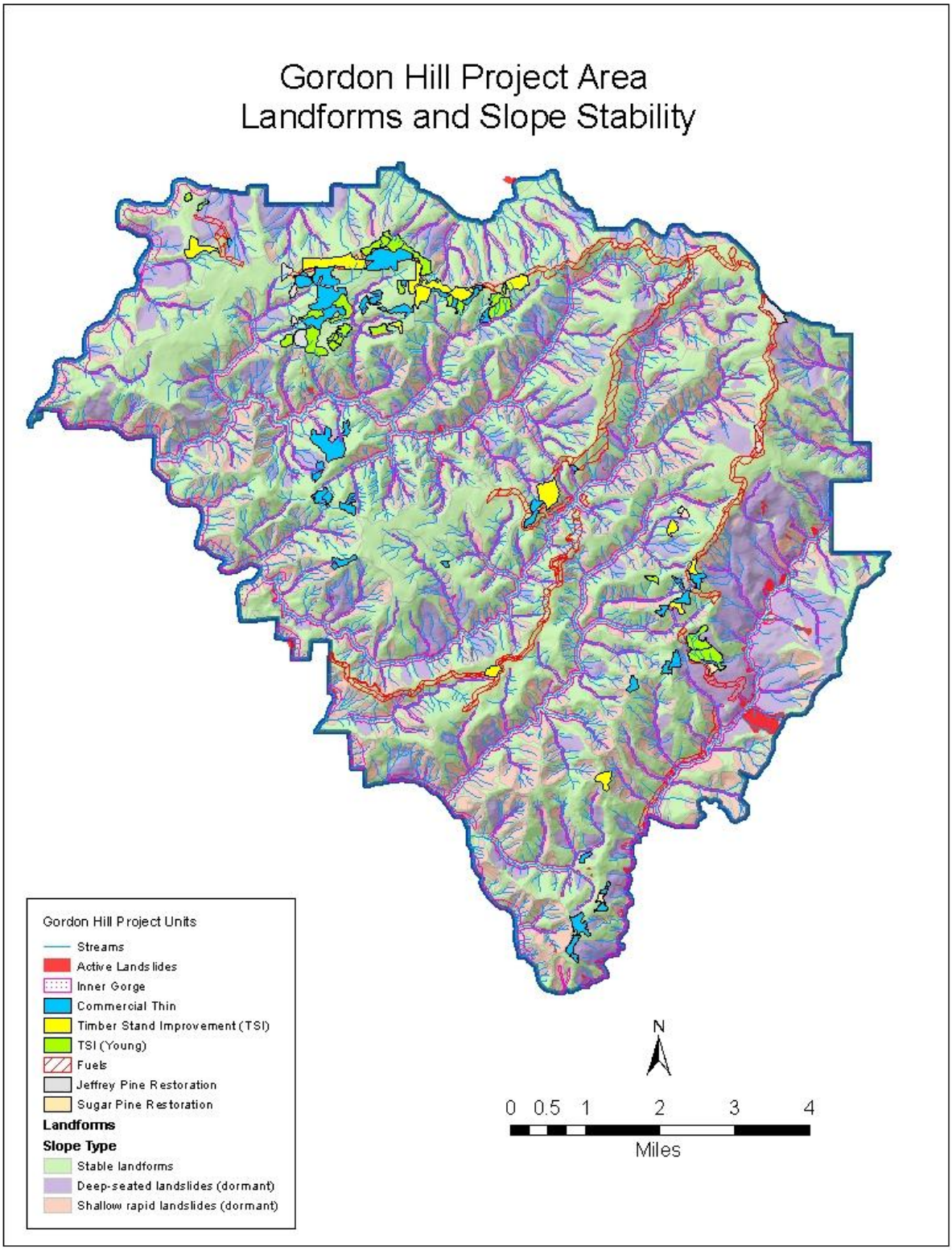


Figure 2. Gordon Hill Project Landforms and Slope Stability, with Gordon Hill project units.

Geologic Hazards

Two principal geologic hazards exist in the project area. These are mass wasting (landslides) and the presence of naturally occurring asbestos (NOA). Potential NOA hazards and mitigations are described below. The existing condition of mass wasting processes and landforms is described in the Geomorphic Processes and Landforms section above, and potential project effects are addressed in the environmental consequences section below.

Naturally Occurring Asbestos

Aside from instability related hazards, there is one other relevant hazard within the analysis area, namely the presence of bedrock that may contain naturally occurring asbestos (NOA). NOA can be found within serpentinite and other ultramafic bedrock units (Van Gosen 2007, Van Gosen and Clinkenbeard 2011). A majority (25,675 acres or 57%) of the analysis area is underlain by these bedrock types (Figure 2). With the exception of the French Hill area, most Gordon Hill commercial units are located outside of areas of ultramafic bedrock.

Naturally occurring asbestos (NOA) includes a suite of fibrous, silicate minerals that are commonly associated with ultramafic rock. Asbestos can pose a health hazard if it is released as dust into the air and inhaled by humans. There is potential for exposure to NOA from dust generated during vehicle travel and during operations that disturb the soil surface in NOA-bearing soil and earth materials. The degree of health hazard from chrysotile, the form of asbestiform mineral associated with serpentinite and the only form present in the analysis area, and the validity of risk assessment methods for asbestos exposure are topics subject to debate in the scientific, regulatory and health advocacy communities (Nicholson 1986, California Air Resources Board 1986, 2000, Berman and Case 2012, Environmental Information Association - unknown date, World Health Organization 2006).

Exposure to NOA can be mitigated by restricting activities and adopting safety measures during operations to reduce or eliminate dust inhalation and associated hazards. A set of such measures is described in the Six Rivers National Forest job hazard analysis (JHA) for potentially harmful dust exposure, applicable to all Forest Service on-the-job activities.

Geologic Resources

The following geologic resources could be affected by proposed project activities.

<u>Groundwater</u>

Springs are present in the project area. They are most frequently located on sideslopes or in benched terrain, and are related to bedrock fractures or large deep seated landslides. All springs within the treatment units are designated as Riparian Reserves and are protected by the Six Rivers LRMP Standards and Guides for Riparian Reserves. Effects of this project on the groundwater resource are expected to be negligible, and as a result it is not addressed further.

<u>Rock and Earth Materials</u>

No new rock sources will be developed within the project area. No rock sources identified as ultramafic or serpentinitic will be used, and consequently Naturally Occurring Asbestos regulations and precautions do not apply. Therefore, effects on/from rock and earth materials for this project are not addressed further.

Caves

There are no known caves or cave-bearing formations such as carbonate (karst) formations or flow basalts in the project area.

Paleontological Resources (Fossils)

As noted above, there is one fossiliferous formation in the project area, the late Cenozoic Wimer Formation (Figure 1). Molluscan fauna of probable late Miocene (6 Ma) are the principal kinds of fossils that have been identified for the Wimer Formation. While there are several Gordon Hill commercial units located in the area of the largest exposure of Wimer Formation in the French Hill/French Flat area, it is not anticipated that project operations will harm or destroy any fossil resources associated with the exposure. This area is greatly previously disturbed by historic mining operations as well as previous timber harvest activities. As no effects from proposed project activities are expected, this topic will not be addressed further.

Geologic Special Interest Areas

There are no designated geologic special interest areas in the project area. While the area is renowned for its excellent exposure of ophiolite suite rocks, no designated geologic areas have been established. It is not anticipated that proposed project activities would affect unique geologic resources. Therefore this topic will not be addressed further.

Locatable Minerals

The project area bears potentially commercial deposits of locatable minerals, including nickel and platinum group elements. It is not anticipated that proposed project activities will affect the presence or accessibility of locatable minerals, or interrupt any current mining proposals or plans of operations. Therefore this topic will not be addressed further.

Desired Future Condition

Desired conditions within the project area include watersheds that are resilient to wildfire and its effects. The road system should survive landslides and debris flows, and should not contribute additional sediment to streams. Project effects should not accelerate mass wasting or sediment delivery, or negatively affect the presence and condition of valued geologic resources. Geologic processes should remain within their natural range of variability as influenced by climate and other natural conditions exclusive of anthropogenic disturbance, except as provided for under law, regulation and policy for activities such as mining, transportation systems and other sanctioned activities.

Riparian Reserves

Certain landforms are very unstable and landslide-prone. Due to the active tectonism, steep topography and highly sheared nature of much of the bedrock in the Klamath Mountains and Coast Ranges, slope instability is pervasive on the Six Rivers National Forest. Unstable and potentially unstable hillslopes are classified within the Riparian Reserves designated by the Northwest Forest Plan (NWFP) and the Six Rivers National Forest Land Management Plan (LRMP). These features include active landslides (including earthflows) and inner gorges (USFS 1995) among the general classification of potentially unstable terrain. Riparian Reserves related to slope instability have been identified on the Six Rivers National Forest through aerial photo interpretation and field inventories, and are archived in the Forest GIS database. Riparian Reserves associated with instability have special project design features to ensure that the

Aquatic Conservation Strategy (ACS) objectives of the NWFP are met, as prescribed in that document and in the LRMP. See the project design features for geology (this document) and Chapter 2 of the Environmental Assessment document for a complete list of project design features related to Riparian Reserves.

In many places, Riparian Reserves do not support riparian vegetation, but are still included in the Riparian Reserve classification because they contribute sediment directly to the stream system during major storm events. For information on the water-associated Riparian Reserves (streams, lakes, ponds, and wetlands), see the hydrology report within this document and the Forest LRMP (USFS, 1995). One of the critical differences between the two types of Riparian Reserves is that there are no inner/outer buffers surrounding unstable areas. Simply, the entire area of instability is a Riparian Reserve which prohibits heavy equipment from entering and dictates vegetative goals for that area.

Environmental Consequences

Methodology

In order to assess the presence of unstable landforms and the risk associated with slope instability and unstable Riparian Reserves within the proposed project footprint, slope stability investigations were conducted through a combination of office and field reconnaissance. Screening criteria applied to choose units for office and field review are described below.

The Six River National Forest GIS database was analyzed with respect to terrain and geologic information. Slope gradient, bedrock geology, aerially-mapped active landslide and geomorphic terrain layers were extracted for the project area. Aerial photography acquired in 2003 at 1:16,000 scale was stereo-interpreted for indications of active mass wasting features in and around the proposed project units. Additionally, plantation units were examined on historic aerial photography, chosen to represent timeframes approximately ten years post-harvest. This timeframe was chosen because, in general, overall root strength of an even-aged harvested stand is at a minimum, approximately ten years following tree removal. (Selby, 1993). Root strength is a key factor in maintaining slope stability on steep vegetated hillslopes. (Ziemer, 1981; Wu and Sidle, 1995).

Fuels treatment units were only examined in the office via photo-interpretation. It is considered unlikely that fuels management prescriptions would adversely affect slope stability, because any proposed mechanized treatments, such as mastication, would be limited to gentle slopes where mass wasting is unlikely to occur. Hand thinning of small-diameter vegetation is considered unlikely to negatively affect root strength or soil water balance to the extent of inducing mass movement. Project design features will ensure that minimal ground disturbance occurs related to hand thinning. Consequently, although a minimal ground area within proposed fuel management units was identified as unstable Riparian Reserves (0.6 acres), these areas will not be designated no-treatment zones, as no negative effects from the proposed treatments are anticipated.

Most plantation units (thinning, TSI and other treatments) were likewise only reviewed through aerial photo interpretation. These former clear-cut stands likely experienced a range of conditions in the ten years following harvest, and so if no sign of mass wasting was visible in the post-harvest photography, it was assumed that the ground in those units was resilient to landsliding, and was unlikely to fail under the lesser disturbance associated with proposed Gordon Hill treatments.

Temporary roads proposed for use, whether existing or new proposals were evaluated for slope stability concerns. Approximately half of proposed temporary roads were field-reviewed. None were judged unsuitable due to slope stability concerns, but several were later dropped or other reasons. All remaining temporary roads in the proposed action (16 existing temporary – 2.8 total miles; 3 new, 0.26 total miles) were judged stable and would not pose any increased risk of mass wasting.

Forty-seven landings are proposed for use, of which nine would be newly constructed. All would be located in stable, gently sloping terrain, on or adjacent to existing roads. The following criteria were adopted for field review of units:

- Mass wasting is visible on aerial photos or has been reported form the field or
- Steep and/or sensitive geomorphic terrain is located within a commercial thinning unit or
- Active landsliding is mapped within a commercial thinning unit or
- Road failures within the project area are visible in the aerial photos, or reported from the field or
- Temporary roads are planned on steep or sensitive geomorphic terrain

Sensitive geomorphic terrain includes inner gorges, headwall basins, landslide toe zones, and landslide deposits. Any units that overlapped these landforms as mapped in the forest geomorphic GIS layer, or on slopes greater than 60%, were selected for field review. In addition, reports from the field of suspected slope instability were also scheduled for field review.

Based on these criteria, the following units and roads were field-reviewed, with these results:

Unit or Road	Rx	Field Review Notes
5	Commercial Thin	Steep but stable – unit dropped
7	Commercial Thin	On dormant slide – unit dropped
10	Commercial Thin	Active slide (earthflow) located in unit. Excluded from unit as RR. Unstable crossing reviewed. NE extension of unit dropped.
11	Commercial Thin	Active slide mapped – not found – talus only. No RR.
13	Commercial Thin	Dormant slide, but no concerns found. Unit dropped.
15	Commercial Thin	Dormant R/T slides, but no concerns found. No RR.
17	Commercial Thin	Active earthflow – RR flagged out. Dormant R/T slide – No RR.
27	Commercial Thin	Active sliding (slump earthflow) located in unit – RR. Unit dropped due to rockfall/sliding on Road 17N39.
34	Commercial Thin	In inner gorge - RR. Old debris flow swale. Unit dropped.
35	Commercial Thin	Steep headwall basin. No RR. Unit dropped.
43	TSI	Changed from CT to TSI – hazardous rockfall area on

16N21. Hand treatment (HPB).

45	Commercial Thin	Steep, some swales, but no active instability. No RR.
47	Commercial Thin	Small shallow slide in 47b – flagged RR.
49	TSI	No landsliding – old mining scar is present.
51	Commercial Thin	Steep, some swales and soil creep. No RR. Unit dropped.
52	Commercial Thin	Steep colluvial slopes – no concerns. Base of unit in stream RR.
53	Commercial Thin	Steep. Much unit is inner gorge. Unit dropped.
54	TSI	Stable landforms. Temp road location OK. Unit changed from CT to TSI.
76	TSI	Temp road reviewed. Above slope break. Unit changed from CT to TSI.
89	Commercial Thin	Dormant slide but no unstable RR.
16N21 -		Hazardous rockfall form overhanging outcrop. Unit 43 changed to TSI to eliminate truck traffic.
17N39 -		Rockfall/cutslope failure makes road use impractical. All proposed units dropped.

Assumptions

Inherent to any scientific analysis certain assumptions must be made. This assessment assumes:

All GIS information is accurate and complete (bedrock, geomorphology, and slope maps; unit and road locations).

It is important to recognize that the mapping products for bedrock, geomorphology, and slope used in this analysis are reconnaissance in nature, and are not necessarily correct at the site level. For example, the slope map used is based on a 10 meter Digital Elevation Model (DEM) derived from a 7.5 minute topographic map. That means that very small features such as swales will not show up in the DEM. Field work, such as that done for this project, allows the geologist to evaluate the mapping in different settings.

Effects of Land Management on Erosion Processes

Often, environmental "disturbances", either natural or human-caused, result in increases in the rate of mass wasting and erosion. These disturbances alter the balance between driving and resisting forces at work on hillslopes. Anthropogenic and natural disturbances can work independently or together to influence slope stability.

The most significant human related activities relative to mass wasting and erosion within the project area have been associated with timber harvest (clear-cuts and roads) (USDA Forest Service, 2003). Harvesting trees affects mass wasting and erosion processes through the reduction of forest canopy, root strength, and decreased evapotranspiration (Ziemer, 1981; Selby, 1993; Wu and Sidle 1995). In general, the soil on a hillslope is most vulnerable to mass wasting

approximately ten years after regeneration harvest. This is because the roots (of the harvested trees) left in the soil have decomposed and are no longer actively binding the soil together. If the slope was re-planted, the 10 year old trees do not yet have a well-developed, strong root structure. Though this statement is particularly true for clear-cut units, it may be relevant to thinned units as well.

Logging roads can influence mass wasting and erosion processes by interrupting or diverting natural drainage patterns, loading sensitive slopes with fill material, and undercutting others. Poor location or design can cause fill failures at water crossings and prism failures on steep slopes (Furniss et al, 1998).

Natural disturbances that have impacted mass wasting and erosion processes in the project area are primarily associated with large storm events. Heavy precipitation can induce mass wasting by saturating the soil, thereby causing pore pressures to increase, or by eroding a supportive soil mass.

Within the time period covered by historic air photos (1940-2003), the single most significant storm event in the area was the 1964 flood. Three large storm/flood events occurred between 1960 and 1975, including the 1964 flood that caused widespread landsliding throughout Northern California, as well as lesser storms in 1972 and 1975. These disturbances had dramatic impacts throughout the project area. Prior to, and during this period, road building and timber harvesting had occurred throughout the lower watersheds. When the storms occurred, slopes that had been clear-cut or roaded were more susceptible to mass wasting processes than other undisturbed slopes (USDA Forest Service, 2003). Management related impacts were more significant in the past when heavy equipment was frequently operated within stream channels and on steep, streamside slopes and sidecast road construction was the norm, regardless of slope steepness. The landslide inventories conducted in the Middle and South fork Smith river watersheds suggest that management related impacts have decreased since 1975.

Wildfire has historically been both naturally occurring and managed. Lightning caused fires usually start on the ridges. In the past, Native Americans burned the hillslopes to maintain acorn producing stands of tanoak trees (a food source). Since 1872 fire suppression efforts have been energetic and extremely successful. Fire suppression has resulted in much denser stands of timber with a greater ladder fuel component. As early as 1918 the Orleans (southeast of the project area) District Ranger commented that fire suppression had caused “thick underbrush, windfalls, and general humus” on the forest floor. Today, the area is considered to have a “high” risk of fire ignition (meaning at least 1 fire per 10 years per 1,000 acres). This is based on fire occurrence and distribution data from 1911 through 2001 (USDA Forest Service, 2003). Catastrophic stand replacing wildfires not only alter the forest ecosystem, but change the soil and increase erosion processes. Large storm events during the first winter after the fire will often result in significant erosion. The development of rills, gullies and debris flows are more frequent after wildfire (for a limited time) due to the removal of ground cover and hydrophobic soil conditions (Moody and Martin, 2001). Debris flows can be especially disruptive ecologically as well as hazardous to humans. They are capable of delivering thousands of cubic yards of sediment to fish-bearing streams or burying communities within a short period of time.

Fuels treatments are meant to return the forest to a more natural state in which fire is part of the ecological system. Fuels prescriptions often include pile or jackpot burning, understory burning, chipping, mastication and removal off-site for use as biomass. Though some ground disturbance

associated with these actions may occur, it is expected to be minimal when compared to erosion due to catastrophic wildfire.

Geo-indicators

Geologic changes occur not only over spans of geologic time, but also at observable intervals of time that can be monitored or measured. Geo-indicators have been developed by the International Union of Geologic Sciences as high-resolution measures of short term changes in the geologic environment. Geo-indicators are significant and useful gauges during environmental monitoring and assessment, as well as in environmental reporting and ecosystem management (FSM 2880.61, paragraph 2). For this project, the indicator used to review the proposed action is the presence of proposed activity (within commercial thin units as well as new temp roads) on sensitive geomorphic terrain, including dormant and active landslides, inner gorges and slopes greater than 60%. The presence or absence of this indicator was derived in the office using GIS analysis. Fuels and pre-commercial thin units were not evaluated with this indicator because these treatments disturb the ground far less than thinning and road construction. See the Effects of Land Management on Erosion Processes section above for more discussion.

Temporal and Spatial Context for Effects

Effects will occur on site, or within the same watershed (6th field Hydrologic Unit Code) as the action which caused them. Short term effects are expected to last less than 5 years. Long term effects will last beyond 5 years. Effects due to wildfire are expected to last for at least 50 years.

Project Specifics Associated with Riparian Reserves

Project Design Features and Best Management Practices (BMPs) will be incorporated into the Timber Sale Contract. For a complete list of BMP's, see Appendix E.

No Action Alternative - Direct and Indirect Effects

Under the no action alternative, the project would not be conducted as proposed, and therefore no direct project effects to slope stability or other geologic resources or hazards would occur. Indirect effects to slope stability could manifest if the project area were subject to a wildfire. The vegetation treatments proposed in the project that are designed to slow fire spread and reduce the severity of wildfire would not occur. Consequently, in the event of a wildfire with high tree mortality, the stabilizing effects of healthy unburned vegetation on hillslope stability documented above could be reduced, leading to increased mass wasting, sediment mobilization and sediment delivery to streams in affected watersheds.

Proposed Action - Direct and Indirect Effects

Direct project effects to hillslope stability and mass wasting occurrence are considered unlikely, because no ground disturbance of the magnitude that might directly initiate hillslope failure is proposed. Road maintenance necessary for project implementation, and temporary road construction might result in minor disturbance and movement of soil and rock, but no direct triggering of new or existing landslides is anticipated, since all proposed road construction was reviewed for the presence of sensitive geomorphic terrain and landslides, and no such hazards are present on roads that remain in the project proposal. Similarly, no proposed landing sites are located in terrain where mass wasting risk is present, so landing construction should have no direct effects to slope stability. The possibility of direct effects to other geologic resources and

hazards was considered when project scoping was conducted and environmental assessment was planned, and no risks were discovered. See the Geologic Hazards and Geologic Resources sections above for discussion of this topic.

Indirect effects to slope stability might occur if ground disturbance or vegetation removal were to reduce the factor of safety of a given hillslope sufficiently to promote slope failure (by reducing evapotranspiration or root strength, disturbing unstable toe zones, scarps or saturated areas, or by oversteepening slopes beyond their stable angle of repose), or if disturbance upslope of an unstable site were to contribute water or sediment in sufficient quantities to destabilize the downslope site. These factors were considered during design of field review of proposed units, landings and roads. As noted above, several areas of existing or potential instability were located during field review, and these areas were excluded from the final project proposal. Therefore, no indirect effects to hillslope stability or any detectable consequences in terms of sediment mobilization or delivery from landslides are anticipated as a consequence of the proposed action.

Proposed Action - Cumulative Effects

The cumulative environmental effects of this project on slope stability ultimately impact water quality. They are addressed within the Hydrology and Water Resources section. The hydrology analysis includes the projected water quality effects of past, present and future foreseeable actions within the cumulative watershed effects analysis area, which encompasses the geologic analysis area

Soil Productivity

Existing Environment

Overview

The Gordon Hill Project area is diverse in vegetation and soil types. The nearby town of Gasquet, elevation 384 feet, annually receives approximately 74 inches of precipitation on average with most of the rainfall occurring between October and May. The area is characterized as having cool, wet winters and warm, dry summers. December is the coolest and wettest month. July is the warmest and driest month (weather.com, July 9, 2013). The project area, elevation range of 1500 to 2500 feet, is within the South Fork Smith River HUC5 watershed, which receives about 120 inches of precipitation per year on average (Black 2014). Given the high precipitation and fertile soils, vegetation is very dense in the area.

The Gordon Hill Vegetation and Fuel Management project is located in the California Ecological Section M261A- Klamath Mountains (Miles and Goudey 1997), primarily in subsections M261Aa (Western Jurassic) and M261AD (Siskiyou Mountains). These subsections are on the western portion of the Klamath Range, with a marine influence partially moderating the Mediterranean climate as more temperate and humid than to the east. The analysis area occupies a montane upland area of the western Klamath Mountains geologic province. The Klamath Mountains consist of a number of accreted terranes of Paleozoic and Mesozoic age intruded by

plutonic igneous rocks both during and following accretion to the North American continent. The project area is entirely within the Smith subterrane of the Western Klamath terrane, the westernmost of the Klamath accreted terranes. Ultramafic rocks of the Josephine Ophiolite predominate, with lesser proportions of associated intrusive rocks and of Galice Formation metasediments. Cycles of erosion, uplift, and incision have formed the modern landscape of the assessment area. Gentle upland topography relict of an ancient erosional surface is preserved on concordant ridge tops.

The project area is along the main ridgetops of French Hill, Coon, and Haines Flat ridges at 1500 to 2500 feet in elevation. Slopes range from 5 to 70 percent, and treatment areas are located on gentle on ridgetops to steep sideslopes. Soils have formed in place on ridges, and primarily from colluvial processes on mountain side slopes, although some historic mass wasting processes have created benchy terrain on some side slopes.

Vegetation within the project area is primarily mixed-conifer forest, largely dominated by Douglas-fir (*Pseudo-tsuga menziesii*), with an understory of shrubs. Soil cover from organic material and vegetation is continuous in most proposed timber units, except where historic skid trails and landings are located. The vegetation can be so dense that old skid trails can be difficult to relocate. Many of these soils are major timber producing soils, supporting a relatively high amount of productivity. The dense vegetation and relatively quick growth rate produces a thick layer of organic material. The thickness of the organic matter varies throughout the project area depending of vegetation type and landscape position. There is a well-developed hyphael/mycorrhizae network in units in the eastern portion of the activity area where the organic matter (O horizon) is well-developed as well. These features lend to soil resilience from disturbance such as disease and drought.

Soils in the project area have developed from colluvium and residuum from gabbro, metaigneous, metasedimentary, sedimentary, serpentinite (Unit 52), and serpentinized peridotite (Units 47a) rock parent materials. According to the Six Rivers National Forest Soil Survey (USDA Forest Service 1994), there are three major soil orders are represented in the project area: Ultisols (69 percent), Inceptisols (18 percent), and Alfisols (13 percent). Ultisols are highly weathered and leached, with lower nutrient status in the subsoil than Alfisols; they are nevertheless quite productive. These soils occupy stable landscape features on top of French Hill, Coon, and Haines Flat ridges, on gentler slopes. Inceptisols are relatively shallow and exhibit only moderate degrees of soil weathering and development. These soils are found on steeper sideslopes. Alfisols are similar to Ultisols, but are deep to very deep with high water holding capacity and clay-enriched subsoil, and represent the more productive soils.

Generally, the majority of the soils within the project area are deep, well drained loams (gravelly to very gravelly) with clay loam subsoils, and moderate to high rock content. High rock content of 35 percent or greater in the surface soils generally reduces the compaction potential of soils (Welke and Fyles 2005). Soil temperature regimes are mesic and moisture regimes are xeric. The soils in the 300-series have metaigneous parent materials, and comprise 74 percent of the project area. The soils in the 200-series have metasedimentary parent materials. These comprise 20 percent of the project area. The soil families are primarily derived by their taxonomic groupings at the family level, thus one soil family may be derived from different parent materials

(e.g. Skalan, Clallam). For a list of soil map units and limitations found within units refer to the Soils report in the project record.

Most of these soils are quite similar from a manageability perspective including similar texture, depth, and interpretive ratings. Several soils have finer surface textures (heavy loams, clay loams) and therefore have high compaction risk ratings. These include Aiken, Skalan and Goldridge. These soil types pose a concern primarily associated with ground-based yarding systems.

Existing Condition of Soils

Methodology for Analysis

For soils, the treatment unit (boundary of harvest or burn unit) serves as the "analysis area." Harvest or fuel treatment units or groups of units are therefore considered the activity area for which direct, indirect, and cumulative effects on soil productivity are analyzed. Temporary roads, skid trails/roads, and landings within unit boundaries are included in the disturbance analysis. System roads and existing landings along them are considered part of the Forest transportation system and are not considered for detrimental soil disturbance.

The temporal scale for assessing soil resource environmental effects includes both short- and long-term impacts. For the purposes of this analysis, short-term effects are defined as those that occur within about 10 years following proposed vegetation treatments. Long-term effects are defined as those that occur within about 10 to 30 years or more following proposed vegetation and fuels treatments.

Soil productivity is a site-specific characteristic. Loss of soil productivity in a treatment unit alone would not lead to a loss in soil productivity in an adjacent stand or other areas across a watershed.

The analysis areas for consideration of cumulative effects are the same as those evaluated for the existing condition and direct/indirect effects. Assessment of cumulative effects on soil productivity as scales larger than the specific treatment unit boundary (such as the watershed scale) misrepresents the effects of management activities by diluting the site-specific effects across a larger area. In contrast to soil productivity, processes such as erosion regimes and hydrologic functions occur at a watershed scale, and have been analyzed as such in the analysis of the Hydrology section.

The Gordon Hill Fuel Reduction project analysis area is used to qualitatively discuss the past activities outside of proposed treatment units. Please see the hydrology resource report for cumulative watershed effects (also see "Past, Present, and Reasonably Foreseeable Actions" in Appendix D).

Effects to soils from roads are long-term, generally defined as more than 30 years. Most activities from thinning have different recovery rates. Compaction of the Gordon Hill project area soils lasts approximately 30 years during which inputs from plant roots, other organic inputs or, physical weathering relieves the compaction. Erosion recovery is three to five years and

fertility is one to two years.

In order to evaluate soil quality, a site-specific assessment of soil quality indicators has been conducted within the analysis area occurring to the Forest Soil Disturbance Monitoring Protocol (FSDMP), which is also known as the National Soil Condition Assessment Protocol (Page-Dumroese et al. 2009). Field soil quality assessments were performed July 2012 through June 2013 by a certified professional soil scientist. Field surveys consisted of random transects with confidence intervals at 90 percent +/- 10 percent wherever practical and included examination of the following indicators:

- Percent detrimental soil disturbance (DSD); defined as a decrease in soil porosity, or increase in soil bulk density, that impairs site productivity.
- Percent cover of bare soil, rock, wood, vegetation, and litter.
- Down woody debris (tons per acre, greater than 3and 7 inches size class).
- Litter/duff depths (forest floor depth).
- Percent of rock in the uppermost soil horizon.
- Noted slope stability concerns, erosion and other soil concerns.

The estimate of detrimental conditions found within the project area is likely higher than the actual soil condition. The field soil survey methodology has been found to overestimate the amount of detrimental soil (Page-Dumroese et al. 2006a; Miller et al. 2010), providing a conservative assessment of existing soil condition. Informal comparisons on the reproducibility of the category calls found that both among a single observer and between observers, the category calls have a variability of 5 to 10 percent (Miller et al. 2010). Soil disturbance was estimated for un-surveyed units with harvest histories by using disturbance found in survey units with similar harvest histories.

The existing and estimated values for detrimental soil disturbance are not absolute, and are best used as a comparative parameter. The calculation of the percent of additional detrimental disturbance from a given activity is an estimate, because detrimental disturbance is caused by a combination of factors including existing groundcover, soil texture, timing of operations, equipment used, skill of the equipment operator, the amount of wood to be removed, and sale administration. The estimation of detrimental soil disturbance assumes that project design features and best management practices (BMPs) would be implemented and that soil recovery would occur over time.

Erosion Potential

Inherent potential for erosion may exist in some areas, given some form of severe disturbance, however upland sites generally appear stable at this time. Ground cover by rock, litter, duff and vegetation was nearly continuous in many places, with the combination often resulting in 100 percent soil cover (sometimes more where canopy overlapped ground cover). There was an average of 5 percent bare ground in the project area.

The litter layer (the layer of organic material that lies on the surface of the soil) was generally intact throughout the project area, but was thicker and more effective in the closed canopy forests versus the open shrubby areas. The litter layer was generally loose, but the shallow duff layer (a

layer of moderately to highly decomposed leaves, needles, fine twigs, and other organic material found between the mineral soil surface and litter layer of forest soil) was generally tighter and was held together by fungal hyphae. This duff layer, where it exists, provides excellent soil protection. Annual grasses, herbaceous vegetation, and even rock fragments can also be a form of protection and may reduce raindrop impact on soils. Some natural erosion in this ecosystem is expected. Closed canopy Douglas-fir forests not only had a more continuous tree canopy, but they appeared to produce the most organic cover found directly on the forest floor and the most coarse woody debris.

Many land use activities have the potential to cause erosion rates to exceed natural soil erosion or soil formation rates. In order to assess the potential risk of a given soil to erode, an erosion hazard rating (EHR) was developed (R5 FSH 2505.22). The EHR system is designed to assess the relative risk of accelerated sheet and rill erosion. This rating system is based on soil texture, depth, clay percent, infiltration, amount of rock fragments, surface cover (vegetative and surface rocks), slopes, and climate. When assessing inherent erosion hazard ratings an assumption is made about the ability of a soil, with little or no vegetation cover, to withstand a precipitation event equivalent to the long-term average occurrence of a 2-year, 6-hour storm. The severity of a soil's erosion hazard can depend on a number of factors including the soil's texture, water movement within the soil as well as runoff potential, slope length, and (importantly) soil surface cover. Risk ratings can vary from low to very high with low ratings meaning low probability of adverse effects on soil and water quality if accelerated surface erosion occurs. Moderate erosion hazard ratings mean that accelerated erosion is likely to occur in most years and water quality impacts may occur. High to very high erosion hazard ratings mean that effects to soil productivity and water quality are likely to occur when accelerated erosion happens. Approximately 30 percent of the ground proposed for treatment was listed by the soil survey as having potentially high erosion hazard rating, 77 percent was estimated as having moderate, and 1 percent of the area within all treatment units was estimated as having low potential erosion hazard rating. Existing erosion hazard rating by family can be found in the soils specialist report (Knapek et. al. 2014). Current EHR ratings were calculated for soil families. All of these soils were determined to have a moderate to low current EHR, and remain moderate EHR with 50 percent cover, with exception of Maymen and Clallam (moderately deep), which are high. The "EHR (slope limit, percent) represents the slope gradient at which the EHR jumps to a high with only 50 percent cover for that soil; this occurs at slopes of 45 to 50 percent for most soils in the project area. Thus, cable corridors on ground greater than 50 percent slopes warrant more concern for surface erosion as well as gully erosion, especially since they are linear features and when entrenched can act as channels to concentrate overland flow. Aiken is the only soil of significant acreage having a have a high burn damage susceptibility rating. Most soils however, have a high EHR when bare, so prescribed burning activities still carry a risk of erosion if too much soil cover is removed, particularly on steeper slopes. Existing erosion hazard rating was considered low in the project area because of the abundance of soil surface cover in the form of rock, organic matter, and live vegetation. Existing erosion hazard was considered low in the project area because of the abundance of soil surface cover in the form of rock, organic matter, and live vegetation.

Soil Porosity (Compaction)
In the Gordon Hill project area, treatment units with relatively mild topography (generally less than 35 percent slopes) appeared to have the greatest amount of existing disturbance from compaction. Evidence of ground based logging and other forest products harvest and recreational use exist within the Gordon Hill Fuel Reduction unit boundaries. Non-system roads and landings that are remaining from past timber harvest and which have not been rehabilitated generally still have low to moderate compaction on older, overgrown roads and landings. Detrimental compaction appeared to occur on old roads and landings, and some (but not all) skid trails. Core bulk density samples were collected on heavily used skid in close proximity of old landings, along with adjacent "undisturbed" samples taken for comparison. Bulk density is then used to calculate total porosity for application of the soil quality standard, which uses a "detrimental" threshold of 10 percent reduction in total porosity.

Loss in total porosity averaged 18.5 percent. The data indicates that on these fine-loamy soils, well-used old skid trails persist over the standard. Secondary skid trails are assumed to be okay, since the heavily trafficked ones are so very close to the threshold. Old skid trails were universally assessed as occupying less than 15 percent areal extent in proposed units, so all units currently meet the LRMP standard.

It is noteworthy that historic ground based logging systems could not have operated these units with this small amount of skid trail extent; for the technology of the day, skid trails typically occupied 10 to 25 percent of the units, depending on size and amount of materials being removed. Apparently, the less-trafficked minor skid trails are simply not observable today, after decades for natural recovery and having little original impacts such as rutting or displacement to leave lasting visual clues. Therefore, the past skid trails that were observed were likely the more heavily-used ones. The minor impacts on minor skids of the past are generally not a concern, as it is assumed they would pass current standards today. The historic main skid trails are where the more severe and persistent impacts are located, and where concerns may exist for their potential contribution toward cumulative effects.

Existing temporary roads and landings are universally assumed to be over threshold. Temporary landings and roads located within the activity areas are subject to soil quality standards, as they remain lands dedicated to growing vegetation after their temporary use.

Organic Matter
Organic matter currently exists in kinds and amounts sufficient to prevent significant nutrient cycle deficits, and to avoid detrimental physical and biological soil conditions, as described below. Kinds and amounts are reported below from the FSDMP surveyed units; ocular surveys in other units were universally consistent with these findings.

Soil Organic Matter (Displacement, Severe Burning)
Detrimental displacement was observed in Unit 2 only, with persistent effects of tractor logging and machine piling. Detrimental displacement was noted on 3 percent of the toe-points in this unit. Based on the limited areal extent in this condition, it is concluded that the unit as a whole currently meets the standard for soil organic matter. Evidence of severe burning (from past pile burning or underburns) was not found in any of the proposed units. Old piles that had been

burned were seen and inspected in several units, which presumably burned hot, but sufficient time has passed such that effects of burning have apparently recovered, with no heavily oxidized or charred surface soils found. These piles were also acceptably “clean” or free of topsoil, so it was assumed that brush rakes had been used in previous machine piling operations, with favorable results.

Fine Organic Matter (Nutrient Cycling)
Fine organic matter, including litter, duff, and woody material less than 3 inches diameter, currently occurs on about 95 percent of the area, and on average is 1.5 inches deep, with a range of approximately 0.8 to 2.8 inches. This is considered sufficient, and all proposed units currently meet the standard.

Coarse Woody Debris (CWD)
CWD consists of logs greater than 20 inches diameter and at least 10 feet long. The LRMP soil quality standard specifies that, where currently existing, at least 5 logs per acre in contact with the soil surface will remain post-activity. In accordance with the standard, where currently existing CWD is deficient, 5 logs per acre is not required post-activity, but existing logs should be conserved to meet the intent of the standard. From the units observed, it was determined that there are on average 4 logs per acre that are greater than 20 inches in diameter.

Infiltration and Permeability (Soil Hydrologic Function)
Water infiltration is reduced on the old main skid trails that are considered detrimentally compacted, which average approximately 5 percent aerial extent and do not exceed 15 percent in any units. Permeability is limited by the finer-textured subsoil, which is generally unaffected by surficial impacts unless exposed by displacement. Complete topsoil displacement was not observed in any substantial portions of any of the proposed units. Therefore, EHR infiltration-permeability ratings do not currently reach 6 or 8 per the standard as applied on these soils, and all units currently meet the standard.

Besides the rating system standard, impaired hydrologic function is conventionally indicated by signs of erosion. In toe-point surveys, minor sheet erosion was not noted in any of the units. Current conditions are judged as meeting the standard.

Desired Future Condition
Although some impacts to soils are to be expected after implementing the project, the desire is to minimize those potential impacts through project design features. After project implementation, the LRMP states that not over 15 percent of the project area should be compacted. Temporary roads and landings that are constructed only for project operations and are to be subsoiled upon completion are included in the compaction calculations. The immediate foreseeable and long-term desired conditions are to maintain long-term soil productivity within all the treatment units. Maintaining or increasing soil cover amounts and coarse woody debris would reduce erosion and protection of soil productivity.

The effect of each alternative on the soil resource was assessed using the following Region 5 Soil Quality Standards or SQS (USFS 1995a) and the Six Rivers National Forest’s LRMP Standards and Guidelines (USFS 1995b). The assessment of each Standard and Guideline will be accomplished by the measurable parameters listed beneath each Standard and Guideline. The

soil mitigation measures or project design features were developed to ensure that the project would meet the following 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 (less than 3 inch-diameter 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 (less than 3 inches in diameter) on site.
   - Retain at least 60 to 70 percent soil cover in order to prevent accelerated erosion from exceeding the long-term soil formation rate.
3. **Retain Coarse Woody Debris (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.
   - Skidding equipment would be generally restricted to slopes less than 35 percent.
5. **Prescribed fire should be planned to minimize the consumption of litter and CWD [SQS 1a, 1c (2a), 1c (2b)].**
   - Prescribed underburning and hand piling would be used to maintain the recommend soil cover amounts and to protect appropriate levels of CWD.
   - Prescribed underburning and hand piling would be used to retain at least 50 percent cover as fine organic materials (less than 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.

Each management activity will be rated for its ability to meet the applicable evaluation criteria by using descriptive terms (low, moderate, moderately high and high). 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 than 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.

Detrimental disturbance consists of two main types of disturbance: detrimental compaction and detrimental displacement. Detrimental compaction is compaction that results in a greater than 10 percent decrease in soil porosity as measured at the 4 to 8 inch soil depth. Detrimental disturbance is where soil displacement of the topsoil removes greater than 15 percent of the soil organic matter in the upper 12 inches of soil (disturbed area must be greater than 1 square meter in size).

The potential effects of the proposed management activities on the soil resource were evaluated using the Pacific Southwest Region Soil Quality Standards, the Six Rivers National Forest's LRMP standards and guidelines, and the Region 5 Preparing Soil Resource Analyses for Inclusion in NEPA Documents (USDA Forest Service 2005) as evaluation criteria. The evaluation criteria specifically address soil cover, soil porosity, and soil organic matter. Indicators of soil quality (erosion, porosity, and organic matter) were used to discuss potential effects resulting from the two alternatives. Alternative 2 (Proposed Action) was compared to Alternative 1 (No Action), using their anticipated effects on soils as well as their ability to comply with applicable soil quality standards as the basis for comparison (Table 18). This assessment is a qualitative estimator based on past experiences, observations and monitoring data.

Table 18. Comparison of Soil Quality Indicators by Management Alternative

Environmental indicators	Alternative 1	Alternative 2 (Proposed Action)
Ground–based treatment acres	0	665 Commercial Thin Acres
Total miles of new temporary roads	0	0.26

Total acres of new landings	0	2.25
Total miles of existing temporary roads to be used	0	2.8
Predicted ability* to meet erosion standards / relative ranking	Meet/1	Meet / 2
Predicted ability* to meet porosity standards / relative ranking	Meet/1	Meet / 3
Predicted ability* to meet soil cover standards / relative ranking	Meet/1	Meet / 2

*Predicted ability to meet soil quality indicators are rated from "Meet / 1" to "Meet / 4" with the "Meet / 1" indicating that the alternative has the lowest potential risk of adverse effects while "Meet / 4" has the highest risk.

Direct and Indirect Effects of the No Action Alternative

Under the no action alternative, no commercial timber harvest or fuel reduction treatments would be implemented to accomplish project goals. There would be no new disturbance resulting from forest management activities, and existing disturbance would persist. No new addition of detrimental compaction would occur, and existing skid trails, the primary cause of detrimental disturbance within the project area, would continue to recover at natural rates. Freeze-thaw processes, weathering, and soil biota would work to slowly break up compaction over time and vegetation would continue to re-establish on the existing infrastructure of trails as their roots become able to penetrate growth-limiting layers of old compaction. No new adverse effects would likely result from this action but in some locations productive potential in the short term may not be as high under this alternative as compared to the action alternatives because historic disturbance would not be alleviated. Hydrologic function, such as soil drainage, would be maintained at existing rates.

Under the no action alternative, the forest canopy would not be altered and organic material covering the soil would not be disturbed by management. Soil cover standards would likely continue to be met and the litter/duff layer would likely continue to thicken and increase in continuity. Coarse woody debris levels are also likely to continue to increase. As a result, erosion hazards would likely remain low and soil nutrient cycles would be maintained.

Indirect effects on nutrient cycling would be maintained as fine organic matter increases in the 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 existing main skid trails would slowly increase their porosity due to biological activities and thereby regain lost soil productivity over the next 20 to 30 years. Existing non-system temporary roads and landings would remain, and soils would continue to recover at a very slow rate.

There would be no soil restoration treatments conducted on all temporary roads, landings and some skid trails. Estimated range of acreage that would be subsoiled that would accelerate the

recovery time for soil productivity is between 36 and 76 acres.

The probability of a high severity fire is not certain to occur within the project area during a given timeframe. However, the fact is that when a fire breaks out, the chances for high severity fire effects on soils can be much higher in untreated areas with excessively heavy fuel loads compared to those that have successfully completed treatment, including post-harvest logging slash (Certini 2005; Cram et al. 2006; Graham et al. 2004; Gorman 2003; Keane et al. 2002).

Vegetation and fuel treatments would reduce the chance that a wildfire could have as severe of an effect on the soils and surrounding private property in treated areas as it could in untreated areas because there would be a reduction in the tons per acre of dead and dying fuels on treated sites.

The occurrence of a high-intensity wildfire would have an increased potential for impacts to soils and soil productivity in severely burned areas, especially since the risk of soil erosion increases proportionally with fire intensity (Megahan 1990). Other effects would include the potential loss of organics, loss of nutrients, and a reduction of water infiltration (Wells et al. 1979). Wildfires that create very high soil surface temperatures particularly when soil moisture content is low, result in an almost complete loss of soil microbial populations, woody debris, and the protective duff and litter layer over mineral soil (Hungerford 1991; Neary et al. 2005). Nutrients stored in the organic layer (such as potassium and nitrogen) can also be lost or reduced through volatilization and as fly ash (DeBano 1991; Amaranthus et al. 1989).

Fire-induced soil hydrophobicity is presumed to be a primary cause of the observed post-fire increases in runoff and erosion from forested watersheds (Huffman et al. 2001). Though hydrophobicity is a naturally occurring phenomenon that can be found on the mineral soil surface, it is greatly amplified by increased burn severity (Doerr et al. 2000; Huffman et al. 2001; Neary et al. 2005).

Soil hydrophobicity usually returns to pre-burn conditions in no more than six years (DeBano 1991). Dyrness (1976) and other studies have documented a much more rapid recovery of one to three years (Huffman et al., 2001). The persistence of a hydrophobic layer will depend on the strength and extent of hydrophobic chemicals after burning and the many physical and biological factors that can aid in breakdown (DeBano 1991). This variability means that post-fire impacts on watershed conditions are difficult to predict and to quantify.

If hydrophobic soils result from a severe high-temperature fire, moderate to high surface erosion could occur because of the soils in the Gordon Hill Project area.

Table 19. Probability of Alternative 1 (No Action) Meeting the Soil Quality Standards and Guidelines

Management Activity	Evaluation Standards and Guidelines					
	1	2	3	4	5	6
None	High	High	High	High	NA	High

Direct and Indirect Effects of Alternative 2 (Proposed Action)

Erosion Potential

Loss of soil productivity can occur as the result of erosion. The amount of erosion that can be

expected as the result of disturbance depends on a variety of factors including soil texture, slope steepness and length, and soil cover. Erosion can be significantly minimized by avoiding certain actions on highly erosive soils, choosing management activities appropriate for given slopes, and by managing for the maintenance of soil cover.

The level of disturbance created by timber harvest activities can vary according to the method employed. The use of ground-based logging systems can result in increased soil disturbance by displacing soil cover through the mechanical action of machine travel. Alexander and Poff (1985) stated that commercial thinning operations which utilized tractors and rubber-tired skidders could result in 34 percent disturbance of a given activity area. The authors also showed that tractor logging of clear-cuts can result in up to 43 percent areal extent of disturbance. But the authors also noted that when skid trail layout was considered, disturbance could be as low as 4 to 11 percent depending on skid trail spacing. Soil disturbance monitoring on the Klamath National Forest (Laurent 2007) of conventional tractor logging with rubber tired skidders showed that an average of 11.5 percent of a particular unit was in main skid trails and landings after harvest. Grapple piling can also increase ground disturbance when the machine turns. Soil disturbance can occur when the equipment turns and the track scrapes the soil surface. But increased ground disturbance, as long as it is not excessive, does not always equate with excessive surface erosion. Soils with high soil strength (loams and clay loams) show much less surface disturbance compared to low strength soils (sandy loams). Soils in the project area should have relatively high soil strength during harvest because operations normally occur during the driest part of the year. When the weather is wet, wet weather operating standards would be followed.

The direct effect of proposed activities will be a temporary reduction of soil cover in portions of proposed units. It is expected that cover will be removed from primary skid trails and landings, which may occupy up to 15 percent area in tractor ground units. Cover will be removed from a portion of cable corridors, where only partial suspension is achieved; this would not typically be expected to exceed 10 percent of a unit. Hand piling and burning of fuels will remove cover beneath the burned piles; in an extensive pile burning study in the Lake Tahoe Basin, the percent area of piles was found to average 3-15 percent area, with a range of 1-29 percent (Busse et. al. 2010), depending of course on the amount of fuels being treated. Therefore, it is conservatively estimated that all units will exceed 70 percent cover post-activity, even where multiple treatments are proposed. The potential exception is broadcast (understory) burn units, which have the potential to remove the majority of soil cover if burned too hot; PDFs specify minimum cover retention requirements for prescribed burns in these units, and burn prescriptions for this type of activity will be expected to incorporate residual cover levels as stated here as a forefront part of the prescription objectives.

LRMP soil quality standards specify that for erosion prevention, soil cover requirements (kind, amount, distribution) are developed at the project level using the R5 EHR system (described above, general results shown in Table 19). Most all of the soils have a moderate EHR with current levels of soil cover. Assuming a minimum residual cover of greater than 50 percent in all proposed activity units, the EHR is raised to high only where slopes exceed 45 to 50 percent. Therefore, all tractor-operated units (being on slopes less than 35 to 40 percent) are acceptable with greater than 50 percent soil cover post-activity. Skyline logging is proposed for 144 acres within Alternatives 2. The use of skyline logging would be expected to cause smaller amounts of soil displacement than ground-based logging systems because the primary disturbance lies in the skyline yarding corridors where the butt end of logs drag over the soil surface. Unlike tractor

logging there is no overland machine travel. Therefore, the affected area tends to be more limited. The spatial area occupied by yarding corridors in skyline operations can vary from 3 to 8 percent (Dyrness 1965; Wooldrige 1960; Klock 1975).

Cable units and hand-treated fuels units on slopes greater than 50 percent will require greater than 70 percent soil cover post-activity, which should be rather easy to achieve for these types of activities. As stated above, it is expected that all activity units will exceed these levels of residual cover with activities as planned and typically conducted. In summary, activities as proposed are not expected to raise the erosion hazard in any areas to a higher level, and this is acceptable to meet SQS post-activity.

Even under undisturbed conditions, erosion occurs at natural levels in the environment. Although minimum recommended levels of cover are proposed to be maintained under the action alternative, erosion may increase somewhat as a result of timber harvest activities. Activities associated with Alternative 2 are expected to have minor effects resulting in erosion, yet not adversely affect the resource due to design features put in place to maintain soil productivity.

Fuels treatments are likely to have a minimal effect on erosion within the project area. Piling, burn piles, and understory burning are expected to maintain sufficient soil cover without causing additional ground disturbance. Proposed burning activities will not likely remove the entire duff layer from the soil surface. Specific fuels treatments are described in detail in Chapter 2.

Temporary road construction creates soil disturbance during the construction process. Road construction work would occur during the dry season and the sites would be stabilized, via the application of project design features prior to winter rains in order to prevent run-off and erosion. The construction of temporary roads may increase the possibility of erosion and runoff during the life of the road, however after they are decommissioned the effect is expected to diminish and fade as the site becomes revegetated once again. Hydrological recovery is expected within the first 10 years with soil infiltration rates lower than natural forest rates (Luce 1997; Foltz and Maillard 2003).

Soil Porosity (Compaction)

Mechanical treatments do have the potential to directly cause detrimental levels of compaction.

Porosity measurements (Knapek et. al. 2014) indicate that old main skid trails and logging corridors in the project area are still detrimentally compacted after decades since previous entry, but found only in minor portions (3 percent of a unit area) of individual units. The direct effect of proposed activities will be to add to the portion of units in a detrimentally compacted condition, particularly for tractor units. Results of these measurements indicate that landings and main skid trails are detrimentally compacted over the long term, while secondary skid trails are much less compacted with condition improving over time within the activity area.

Activity units with ground-based tractor harvest would be restricted to skidding upon designated skid trails, which shall occupy 15 percent or less of the activity area. In units that have existing skid trails from prior entries, the old skid trail system will need to be reutilized to the extent feasible to achieve the standard. In cases where the 15 percent limit is not achievable due to

cumulative impacts or operational feasibility, additional mitigation (such as subsoiling) would be required on a site specific basis to mitigate detrimental compaction and would be required by the timber sale contract. Sale administration staff and the project soil scientist would coordinate to determine such areas where mitigation measures may be necessary to repair unavoidable adverse impacts (refer to PDFs in Chapter 2).

Cable units and timber stand improvement units are fully expected to meet porosity standards without limitations on operational methods, as the potential to detrimentally compact more than 15 percent area is very low for these types of activities. Existing and proposed landings are expected to be detrimentally compacted throughout their areal extent; however "permanent" landings (and roads) are considered to be part of the permanent harvest access system where SQS do not apply. Conversely, "temporary" landings (and roads) are not dedicated to other uses than growing vegetation, so SQS do apply; these harvest system features will be heavily compacted throughout, and would require post-use mitigation (i.e., subsoiling PDF) to reduce compaction and restore hydrologic function.

In summary, all proposed activity units are expected to meet soil porosity standards post-activity. Units where this not achieved as an end-result, as well as "temporary" roads and landings, will require additional mitigation efforts (i.e., subsoiling PDF) to reduce compaction and restore hydrologic function. Subsoiling, although a potential short term impact to water quality, is a long term benefit to soil productivity. Refer to the Hydrology Report for the impact analysis for hydrology and water resources.

Soil Organic Matter (SOM)

SOM can be impacted by topsoil displacement and/or severe burning effects. Expected direct effects of proposed activities will be minor amounts of displacement and burning effects, limited to small portions of individual units. Effects should be short-term in nature and should not pose long-term impacts to soil productivity.

Displacement is expected in tractor units on a small sub-portion of the skid trail system, particularly on the main skid trails and especially in proximity to landings where skid trail use is most intensive. The skid trail system as a whole should occupy less than 15 percent areal extent, and portions with displacement should typically be less than a third of that, so we might expect up to 5 percent areal extent of displacement. Notably, SQS do not establish a minimum area or areal extent threshold for displacement, but 15 percent is conventionally used. The new R5 SQMS specifies a minimum 100 square foot area for displacement, but likewise does not specify an aerial extent threshold, as the significance of displacement is best evaluated in a site and soil specific manner.

Burning effects are expected to be mixed depending on the type of burn operation. For pile burning, soils may be severely heated under the piles due to the residence time associated with consumption of concentrated fuels; however, areal extent and spacing of burn piles greatly mitigates the concern level for soil quality to a low to moderate level. Effects are typically different for prescribed understory broadcast burns (underburns), where soil heating is less severe but more widespread. Burn prescriptions that aim to retain soil cover as prescribed above

should result in a relatively ‘cool’ mosaic-pattern burn, and severe soil heating is not expected for any significant portions of burn areas. Furthermore, burning effects are usually surficial, affecting only the surface few inches, and temporary in nature as soils rebuild organic matter from microbial biomass and fine root turnover.

Surface Organic Matter (Litter/Duff)
Surface organic matter (litter and duff) will be affected by physical removal from equipment and material skidding, and/or by burning of surface fuels and hand-line construction. Hand lines ranging from 18 to 21 inches wide would be constructed in strategic points within Jeffrey pine and sugar pine restoration units. Hand lines would also be constructed in the other timber stand improvement and commercial thin treatment units when needed for hand piling and burning. Direct effects of the proposed activities will be removal of litter/duff from minor portions of individual units, in the same proportions and for the same reasons as discussed above. SQS specify a minimum of 50 percent cover retention to prevent nutrient cycle deficits, and given fuels reduction objectives for the area this is considered acceptable for soil resource protection. A minimum of 0.5 inch layer thickness is considered sufficient to ‘count’ as surface organic matter cover. As discussed for soil cover, it is expected that all activity units will exceed these levels of residual organic matter cover with activities as planned and typically conducted.

Coarse Woody Debris (CWD)
The SQS specifies that, where currently existing, at least 5 logs per acre in contact with the soil surface would remain post-activity. Per the language of the standard (where currently existing), units that do not meet the standard pre-activity are not expected to meet the standard post-activity; however to meet the intent of the standard, whatever CWD does currently exist in deficient units would be conserved to the extent possible.

The SQS also state that the large woody material requirement may be waived in strategic fuel break areas. While this may be applicable for this particular project, it is the intent to meet the 5 logs per acre standard post-activity for this project, and project PDFs specify that this standard would be met.

LWM can be physically avoided with tractor operations, cable operations, and piling of fuels for burning. LWM will be vulnerable to loss with understory broadcast burns (underburns), so burn prescriptions would have prescriptive measures to protect LWM, particularly for pieces in higher decomposition classes.

Infiltration and Permeability (Soil Hydrologic Function)
Soil hydrologic function is primarily affected by compaction. Therefore measures in place to limit the severity and extent of compaction (described above) would likewise limit detrimental effects to infiltration and permeability to minor portions of proposed activity units. Limitation of skidding to less than 15 percent area and retention of soil cover for erosion control and nutrient conservation are considered sufficient to avoid adverse impacts to soil hydrologic function in units as a whole. Soil hydrologic function will be impacted on main skid trails, landings, and temporary roads. Skid trails should not require mitigation (subsoiling or ripping) because of their limited extent, but as already stated “temporary” landings and roads will require mitigation measures to restore soil hydrologic function and soil quality as growing space for vegetation.

Summary of Direct Effects

Fuels treatment are proposed in 43 percent of the activity area, timber stand improvement/hand treatments are proposed in 29 percent, and Jeffery pine and sugar pine restoration in 4 percent of the activity area, and direct effects of all types here are quite minor; no detrimental direct effects are expected. Commercial thin (tractor ground-based and cable-based) treatment is proposed in 24 percent of the activity area. Ground-based mechanical treatments are proposed in 19 percent of the activity area, where some unavoidable adverse effects in small portions of these areas are anticipated as a result of project activities. Cable-based mechanical treatments are proposed in the remaining 5 percent, where some unavoidable adverse effects would occur, but to a lesser extent than ground-based treatments. PDFs were developed specifically for these project activities to avoid or limit detrimental disturbance in project areas at large, and to mitigate unavoidable adverse effects where they are reasonably expected to occur. Net detrimental soil conditions may be expected in very small portions of activity areas, but not of an extent to be of concern with respect to SQS, key soil functions, or long-term soil productivity. Soil hydrologic function will be maintained, and accelerated surface runoff is not expected in any contiguous areas large enough to be considered significant. SQS should be met immediately post-project.

Summary of Indirect Effects

Indirect effects are off-site effects upon watershed hydrology and/or water quality. Soil erosion and hydrologic function, as potentially affected by project activities, have the potential to create indirect effects. Eroded sediment delivered to streams can impact water quality. Damaged soil hydrologic function, via compaction, can lead to increased runoff, which can affect the quantity and timing, of stream flows during precipitation events. Significant indirect effects associated with the proposed action are not anticipated given the LRMP standard and guides are met, and project design features are implemented as intended.

Table 20. Probability of Proposed Action Meeting the Soil Resource Evaluation Standards and Guidelines

	Evaluation Standards and Guidelines					
Management Activity	**1**	**2**	**3**	**4**	**5**	**6**
Ground-Based Equip. Yarding	High	High	High	Mod-High	NA	High
Cable Yarding	High	High	High	Mod-High	NA	High
Landings	High	High	High	NA	NA	NA
Hand Piling	High	High	High	NA	High	High
Underburning	High	High	High	NA	High	High

Cumulative Effects on Soils

Watershed Scale

The cumulative effects assessment area for the soils resource is bounded in space within the proposed activity units, and includes any new road construction or reconstruction as connected actions, because this is the full extent of where soil disturbing activities take place. Effects analysis is bounded in time by past, present, and reasonably foreseeable future actions within that area. Please refer Appendix D for a full description of projects recently completed, projects currently being implemented, and reasonably foreseeable future actions.

For the soil resource, the area for consideration is the unit because effects on soils are site specific.

Past Timber Harvest

Many areas within the Gordon Hill Fuels Reduction Project area have records of past disturbance from the 1960s to the present and field verification of past disturbance was completed (refer to the "Vegetation" and "Past, Present and Reasonably Foreseeable Actions" sections in Chapter 3 and Appendix D). Several units have old skid trails going up/down slopes greater than 35 percent and skid trails in draws. Although reusing skid trails is generally recommended, to protect the soil resource from erosion, these particular skid trails shall not be reused and they shall be restored with coarse woody debris.

Cumulative effects of timber harvesting on units with little or no signs of previous disturbance would experience the least if any cumulative effects from harvesting.

Cumulative effects on moderately disturbed units (6 to 10 percent detrimental disturbance) where ground-based logging and thinning are proposed would likely experience short-term soil productivity losses. Employing all appropriate Design Features and strategies (see "Connected Actions Associated With the Action Alternatives", Chapter 2) would maintain natural biophysical resiliency and allow soils to meet Regional soil standards in a timely fashion.

Many of the proposed units have been timber harvested in the past. The harvested units were clear cut, broadcast burned, planted, and subsequently thinned. On most units clear cutting occurred between 1960s to1970s, followed by broadcast burning the same or following year, and thinned about 20 years later. Refer to the Hydrology Report for the Cumulative Watershed Effects analysis, which includes analysis of past logging events.

Units that have experienced a moderate to high amount of detrimental disturbance in the past are vulnerable to cumulative nutrient effects (especially on dryer south and west facing units in the project area), soil porosity decreases, and loss of soil productivity. Past harvest activities have removed considerable amounts of carbon, decreased annual litter fall for a time, and increased soil bulk density especially on skid trails and landings. This past activity combined with the proposed action of harvesting and burning could lead to cumulative impacts on nutrient cycling and soil productivity in general. Most important is protecting those elements and processes that maintain nutrient capital and cycling. Again, employing design features and maintaining intact organic layers would ensure no cumulative nutrient-related effects. Six Rivers LRMP guidelines require that soil productive capacity not be reduced below 15 percent over the planning horizon

(FSH 2509.18, Soil Management Handbook, WO Amendment 2509.18-91-1). Units with unacceptable soil disturbance, design features would focus on PDFs such as activity during the dry time of the year, reuse of old skid trails, avoidance of ground-based systems on potentially sensitive sites, and remedial action on areas of concern incorporated into the proposed action to protect the soils in the Gordon Hill project area. Adverse cumulative effects on soil resources are not expected to occur within the analysis area or the activity areas from the implementation of any of the action alternatives.

Disturbance data was collected on 11 of these units. The range of detrimental disturbance was 0 to 3 % detrimental displacement and 0 to 7% detrimental compaction (7% was for unit 250 which was dropped from the project). The direct effects of the proposed action are minimal due to integrated project design features. Cumulative effects will not approach the 15 percent reduction in soil productivity threshold with implementation of the project design features.

There are no treatment units within the Gordon Hill project boundary that have been exposed to high severity wildfire since at least 1996 (the 2007 Pioneer Fire was not within a treatment unit). A 15 year recovery period is typically used in assessing watershed and soil cumulative effects in regard to fire. The project will likely be of net benefit in these areas. The proposed action will not produce any significant amount of adverse direct or indirect soil impacts. Therefore, the proposed action in combination with past actions will not produce adverse cumulative effects.

Climate Change and Soils

The climate in Northern California is predicted to change in the near future. Increases in temperature are likely and a change in precipitation is predicted as well but there is no clear trend on precipitation changes (CEC 2006). What changes will actually occur and how these changes will affect the soil resource is still unknown. Increased precipitation could lead to increased erosion from rainfall (Nearing et al. 2004), but this is unlikely in the Gordon Hill Project area because of slopes and lack of water. Increased precipitation could also lead to higher soil moisture levels and increased productivity (Nearing et al. 2004). Also predicted is a shift in species composition which could affect the soil resource (CEC 2006). Changes in species could affect litter and duff layers, nutrient cycling and soil productivity. An increase in soil temperature could lead to an increased decomposition rate as well. There should be no detectable cumulative effects to soils from global warming in the project area if soils project design features are implemented. Cumulative effects to climate change are not anticipated as a result of this project as it is infinitesimally small/de minimums when compared to a global scale.

Warmer temperatures will likely reduce available soil moisture, especially from mid to late summer, and increase the length of wildfire season in some middle and upper elevation forests. Fires will be fueled by increased tree mortality and summer flammability. Some project a 30 to 50 percent decrease in forest productivity; however, increased atmospheric carbon dioxide (CO2) concentrations may result in a 10 to 20 percent increase in forest growth and an increase in soil and forest floor organic matter.

Northern California is projected to experience a 4 to 6 degree increase in temperature, 12 to 25 centimeter decrease in annual precipitation, decreased snowpack, and a 55 percent increase in wildfire risk through year 2099 (Adams et al. 2009, Cayan et al. 2008, Chambers and Pellant 2008, Field et al. 1999).

At present, most studies suggest that pre-commercial and commercial thinning, along with prescribed burning treatments do not substantially affect mineral soil C storage (Boerner et al. 2009, Johnson and Curtis 2001), and thus would not be expected to either mitigate or exacerbate atmospheric C02 levels.

Hydrology, Water Quality, and Riparian Reserves

The Smith River is well known for its inherent clarity and low turbidity. Turbidity levels are very low and are reflective of the hard ultramafic rock and coarse parent material, and the subsequesnt coarse substrate that dominates streams of the Smith River basin. Turbidity data has been recorded during storms following wildfire - an indication of the expected level of ash delivered from hillslopes into channels during storms. One of the highest turbidity readings for the Smith basin was observed in November 16, 2002 during the first major storm that followed the Biscuit Fire of 2002, where turbidity (presumably from ash runoff) peaked at 74 turbidity units at 8:45 pm. The turbidity dropped back to 8 by 8:00 pm the following day. The stream maintains a low turbidity level during a very high storm flow (>100 year return interval) and recovers very quickly from a large pulse of wildfire ash.

Water temperature in mainstems of the Smith River is beneficial to federally-listed fish, and ranges from 5 degrees C in winter (in tributaries) to 23 degrees C in late summer (40 to 75 degrees F) (USFS 1976 to 1985). Due to the proximity to the coast and the maritime rain precipitation patterns, stream temperatures rarely approach the freezing point. Shade is provided mainly by red alder, bigleaf maple, Douglas-fir, incense cedar, and Port-orford cedar. Some dense shading from redwood occurs in the western part of the project area. In the anadromous reaches of the Smith River, shade canopy ranges from 20 to 83 percent (USFS 1976 through 1985). The range in water temperature in the Smith River is considered properly functioning.

The road system directly affects riparian communities where it impinges on riparian areas. Roads can indirectly affect riparian communities by intercepting surface and subsurface flows and routing these flows so that riparian areas dry up and the riparian vegetation is replaced with upland vegetation. Riparian plant communities play a vital role in providing shade. Removal or degradation of these communities can affect stream stability and water temperatures, which in turn, affects aquatic habitat.

The condition and function of the riparian reserves varies throughout the project area. Functions provided by the riparian reserves that are important for aquatic TES species include shade canopy, large woody debris (LWD) production from the mortality and recruitment of mature trees, protection of small floodplains important for overwintering habitat, and production of nutrient and food sources. As described above, the shade canopy is currently adequate to maintain stream temperatures within the range necessary for productive salmonid habitat.

The primary beneficial uses in the project area are domestic water sources and aquatic resources. There are no impoundments or significant water withdrawals except for limited domestic use. Management-related sediment delivery is the primary water quality indicator that is of concern in the project area.

Hydrology and Water Quality

Environmental Consequences

This analysis is focused on the effects of the following actions: (1) vegetation management treatments in riparian reserves (2) construction and re-construction of temporary routes and landings (3) temporary upgrade of system roads (4) temporary roads decommissioned. Table 21 compares the measurable indictors between alternatives and is described in greater detail by alternative. The primary beneficial uses in the project area are domestic water sources and aquatic resources. There are no impoundments or significant water withdrawals except for limited domestic use. Management-related sediment delivery is the primary water quality indicator that is of concern in the project area. The following table compares the measurable indictors between alternatives and is described in greater detail by alternative.

Table 22 – Water Quality Indicators for the Gordon Hill Vegetation and Fuel Reduction Project.

Measurable Indicators	Alternative 1 No Action	Alternative 2 Proposed Action
Proposed Treatments		
Commercial Harvest *Acres* in Riparian Reserves.	0	62
Non-Commercial Fuel Reduction and Timber Stand Improvement *Acres* in Riparian Reserves.	0	261
Roads and Landings		
Miles of Post-Implementation Road Decommissioned.	0	3.06
Miles of New Temporary Road Construction.	0	0.26
Miles of Existing Temporary Road Utilized.	0	2.8
Miles of Temporary Upgrade of Existing System Road.	0	1.08
Number of New Landing Construction.	0	9
Number of Existing Landings Utilized.	0	38

Alternative 1 – No Action

Direct and Indirect Effects

Under the No Action alternative, no commercial thinning, timber stand improvement (pre-commercial thinning), fuels treatments or strategically located shaded fuelbreaks would be constructed. The No Action alternative would not change the current conditions. Silvicultural prescriptions would not be applied to younger stands in order to accelerate their development toward late seral conditions. These treatments could increase the amount of late seral vegetation sooner than would occur naturally.

There would be no direct effects on fire behavior, specifically to the torching index and potential flame lengths. There would also be no direct effect to the fuel loading. Aggressive fire suppression would continue to be the only strategy available during critical fire weather periods.

There would be a greater risk of adverse effects to water quality as a result of a high severity wildfire. It is always very challenging to predict the level of potential sediment delivery associated with a future wildfire. Postfire erosion is affected by geological substrate, burn severity of the fire and precipitation events.

Under the no action alternative, it is likely that a substantial portion of the project area would be lost primarily because these plantations have unusually thick concentrations of pole size trees. Wildfire could rapidly spread in these areas where the canopies are interlocked and ladder fuels are present, increasing the risk of elevating peak flows and subsequently increasing sedimentation to water courses.

This alternative would not promote *attainment* of ACS objectives within the project area.

Cumulative Effects

The hydrologic response to high severity wildfires is well documented in the literature. Sediment from eroding hillslopes adversely affects water quality in forest streams. The increased number of disturbances from active forest management results in lower long-term average sediment delivery rates than would occur following less frequent wildfire disturbances (Elliot and Robichaud 2001).

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. 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 the current condition of vegetation and subsequent fuel density levels.

Silvicultural prescriptions would not be applied to younger stands in order to accelerate their development toward late seral conditions and thereby continue to grow thick, dense stands which can also increase the risk for high-intensity wildfires in the long-term.

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

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action will treat approximately; 665 acres through commercial thinning, 801 acres of timber stand improvement and 1168 acres of fuel treatments. Approximately 31 miles of strategically located roadside/ridge top fuelbreak will be created. Also included in the proposed action are 20 acres of sugar pine restoration and 95 acres of fuel reduction/prescribed burning in Jeffery pine grasslands.

The table below lists which treatment units have riparian reserve designations.

Table 32 – Treatment Unit Numbers with Riparian Reserve Designations

Commercial Thinning from Below	Shaded Fuel Break		Timber Stand Improvement	Jeffery and Sugar Pine Restoration	Pre-commercial Thinning
2	F-01a	F-34a	393	78	25
3	F-01b	F-36a	401	80	47
9	F-03b	F-406a	404	81	77
10	F-04b	F-40a	411	244	
22	F-05a	F-41a	412		
23	F-05b	F-43a	413		
45	F-06b	F-44a	417		
47	F-07a	F-45a	419		
52	F-11a	F-46a	420		
58	F-11b		421		
82	F-12a		424		
84	F-13b		430		
91	F-14b		431		
207	F-15a		432		
4a	F-18a				
	F-19a				
	F-19b				
	F-26b				
	F-27b				

The proposed action alternative does require 0.26 miles of new temporary road construction. All proposed new temporary road construction locations are ridge top, require no bench cuts, have no road- stream crossings or road drains. Road-stream crossings are the primary sediment sources associated with roads. All new temporary roads will be decommissioned, left in a free draining condition and physically closed to motor vehicle use after project completion

Previously used temporary roads will be utilized again for this project (approximately 2.8 miles) and the work associated to utilize these roads is limited to brushing, clearing, grading and blading of previously established travel ways. There is a very low to no risk of sedimentation to stream channels associated with the previously used temporary road since they are located in the upper third of the ridgetop or on flat ground where there is minimal to no cut and fill areas and have no stream crossings.

Approximately 1.08 miles of *existing* system roads will be upgraded only for use associated with this project. This work consists of blading, grading, brushing and clearing only. These are roads that have not been maintained for motorized travel in several years. All system roads that were upgraded for implementation will be physically closed to motor vehicles and left in a hydrologically maintenance free condition once the project has been completed. There is a very low risk of sediment from the reconstruction of 1.08 miles of OML 1 roads to OML 2 for the

project because the roadbed and culverts are pre-existing and require very minor ground disturbance to bring the roads up to standards.

There is a very low to no risk of sedimentation of stream channels associated with the utilization of *existing* landings and skid trails since these sites are located outside of inner (no treatment zones) riparian reserves areas where minor soil displacement is not likely to reach stream courses. Utilization of existing skid trails will be limited to no more than 15 percent of each harvest unit. All used skid trails will be left in a free draining condition.

Most landings are located at wide spots, adjacent to existing roads and would require very little ground disturbance to be functional. All landings used will be left in a free draining condition upon completion of the project.

The proposed treatments and associated roads are of such small extent (i.e. thinning from below compared to clear-cutting, less than 0.26 miles of new temporary road and utilization of existing system and previously used temporary roads) that changes to water quantity (peak and low flows) would not likely be measurable or detectable.

BMP effectiveness monitoring of other similar type projects on the Smith River NRA (for example, Big Flat Vegetation and Fuel Reduction EA) indicates that there has been little to no sediment delivery associated with past fuels and vegetation treatments on the Six Rivers (2001-2010 Six Rivers BMP reports).

In the event that a wildfire does occur within the project area and assuming that all proposed treatments have been implemented under Alternative 2, there is a greater probability that the risk and extent of high severity fire will be reduced when compared to no treatments associated with Alternative 1. With a reduction in acres impacted by high severity fire, there will be a reduction in sedimentation rates.

Ground disturbing activities such as ground-based yarding systems have the potential to result in erosion and potentially result in sedimentation into adjacent stream channels. These activities can 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 stream channels and the slope steepness of treated areas. Generally speaking, ground-based activities such as endlining are conducted on gentle slopes (less than 35% which have less potential to mobilize sediment) and combined with equipment exclusions of 160 ft (riparian reserve design criteria), the risk of sediment delivery is very low. The risk of sedimentation associated with endlining or ground-based cable yarding is limited because to the dragging of small diameter trees (7-12” DBH) in the outer portions of the riparian reserve (80 feet on either side of the channel or to the break in slope, whichever is greater). It is not anticipated that extensive yarding corridors or bare ground patches will develop as tree limbs would suspend the bole as it is dragged, with the lightest part of the tree being on the ground and because of the relatively low amount of material to be harvested. The Six Rivers Best Management Practices Monitoring reports dating back to 2001 show that streamside management zones (riparian reserves) associated with vegetation treatments has been 100% effective in preventing sediment delivery.

The project design standard for canopy cover requires 40-60% of the cover to remain undisturbed and is expected to protect the existing streamside shade canopy and help maintain

stream temperature after implementation. Fuels treatments such as understory burning will involve low intensity surface fire that will consume surface fuels while limiting damage to the residual stand. No firelines will be constructed in riparian reserves. No mastication would occur in riparian reserves. Understory burning and pile burning will not occur within designated no-treatment zones in riparian reserves. The potential for ash to enter channels from understory burning would be minimized and the effects to water quality would be negligible.

Overall there is high confidence that potential impacts to water quality and quantity associated with Alternative 2 will be very small and not measurable based on the facts that:

1/ All temporary roadbeds and landings to be utilized are not hydrologically connected and do not have any stream crossings. Temporary roads will be decommissioned and closed to motor vehicle traffic after use.

2/ The majority of proposed treatments within riparian reserves would be implemented by hand (approximately 261 acres), without the use of ground disturbing machinery.

3/ Riparian reserves will have very limited ground disturbance associated with endlining and cable yarding (approximately 62 acres) and will occur only in the outer portion of riparian reserves where treatments are designed to meet the aquatic conservation strategy objectives.

4/ Project design features and the limited scope of ground disturbing activities on the landscape are adequate to minimize any adverse impacts to peak or base flows in the project area.

Cumulative Effects

The cumulative effects of the proposed action alternative may result in a minor short-term impairment to water quality or quantity and would have no measurable effect on aquatic resources and 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 implementation. However, the proposed activities would *not* result in cumulative watershed effects that threaten impairment of long-term water quality objectives (see cumulative watershed effects section). The implementation of specific project design features such as; designated no treatment zones within riparian reserves, minimal new temporary road construction, no treatment buffer in riparian reserves and limited ground disturbance in the outer portion of riparian reserves, and 75 percent of *all* treatments would be accomplished by hand or with minimal ground disturbance (associated with low intensity under burns in the fuel treatment units and Pine restoration units).

Several studies have examined effectiveness of buffers in controlling sediments from clear cut timber harvest on forested lands. Broderson (1973) concluded that buffer widths of 15 meters (50 feet) controlled most sediment on slopes less than 50 percent and buffers of 61 meters (200 feet) were effective on extremely steep slopes. Corbett and Lynch (1985) recommended buffers of 20-30 meters (66 to 100 feet) for controlling sediments. Lynch et al. (1985) concluded that buffers of 30 meters (100 feet) removed 75 percent to 80 percent of suspended sediments draining areas that had been cleared and burned. The FEMAT Report (1993), citing these same studies, concluded that buffers of approximately one site potential tree height from the edge of the floodplain are adequate to control sediments from overland flow in most situations. Clear cut timber harvest (referenced in these studies) generally involves a relatively higher level of disturbance intensity and severity than thinning to 60% canopy, and a higher likelihood of

surface erosion and sedimentation. Therefore, it is determined that for the proposed thinning and fuel treatment actions, 50 feet would be adequate to filter and trap sediment (and retain the sediment within the buffer) and prevent any significant amount from entering watercourses and ultimately being transported downstream to fish habitat occupied by federally listed salmonids.

The project design standards of canopy cover to be maintained to a minimum of 40 in the treatment units is expected to protect the existing streamside shade canopy and help maintain stream temperature. Fuel treatments such as understory burning would involve low intensity surface fire that would consume surface fuels while limiting damage to the residual stand. No firelines would be constructed in riparian reserves. No mastication would occur in riparian reserves. Understory burning and pile burning would not occur within the core no-treatment zones in riparian reserves. The potential for ash to enter channels from understory burning would be minimized and the effects to water quality would be negligible.

Overall there is high confidence that potential impacts to water quality and quantity associated with Alternative 2 would be very small and not measurable based on the facts that: 1) All existing roadbeds and landings to be utilized for temporary use are not hydrologically connected and do not have any stream crossings, 2) the majority of proposed treatments within riparian reserves would be implemented by hand, without the use of ground disturbing machinery, and 3) riparian reserves would have very limited ground disturbance associated with endlining and cable yarding (less than 48 acres) and would occur only in the outer portion of riparian reserves where treatments are designed to meet the Aquatic Conservation Strategy (ACS) objectives.

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. R1-2010-0029). See Appendix D for more information on how cumulative effects of these actions were derived.

Riparian Reserves

The project area encompasses portions of Hardscrabble-Myrtle Creeks, Lower Middle Fork Smith River, Hurdygurdy, Lower South Fork Smith River watersheds and the entire Craigs Creek watershed. Stream channels within and adjacent to treatment units are headwater ephemeral or intermittent streams and lower valley perennial streams. Perennial streams within the project area are: Hurdygurdy Creek, Craigs Creek, Redwood Creek, Coon Creek, Gordon Creek, Deer Creek, Lower South and Middle Forks Smith River.

The riparian reserves within these plantations have been significantly altered relative to vegetation composition and age (Table 23). Past timber harvest activities within riparian reserves has resulted in a legacy of high fuel loads 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 conifers with little riparian diversity even within the immediate vicinity of the stream channel.

Table 23 - Seral stages of riparian reserves listed by proposed treatment

Seral Stage by Treatment Type	Riparian Reserve Acres	Percent Total Acres by Seral Stage
Commercial Thinning From Below		
Early Mature	24.9	40%
Mid Mature	25.4	41%
Old Growth	0.1	0.2%
Pole Natural	1.7	3%
Shrub/Forb Harvested	9.4	15%
Shaded Fuel Break Treatments		
Early Mature	49.9	42%
Mid Mature	40.1	34%
Old Growth	7.0	6%
Pole Natural	8.1	7%
Shrub/Forb Harvested	12.2	10%
Shrub/Forb Natural	1.5	1%
Jeffery and Sugar Pine Restoration		
Early Mature	8.9	53%
Mid Mature	2.5	15%
Shrub/Forb Harvested	0.6	3%
Shrub/Forb Natural	4.9	29%
Pre-commercial Thinning		
Early Mature	1.7	11%
Mid Mature	12.7	85%
Shrub/Forb Harvested	0.6	4%
Timber Stand Improvement		
Early Mature	28.8	26%
Mid Mature	0.9	1%
Pole Harvested	8.0	7%
Shrub/Forb Harvested	73.3	66%
Grand Total	**322.9**	

It is important to note that the plantations within the project predate the Northwest Forest Plan and the Six Rivers LRMP. Most of the riparian reserves in plantations were completely harvested (no streamside buffers). The effect of this past management was that few to no large trees remain in most plantations. The effects of these management actions have reduced large woody debris recruitment potential and elevated fuel loads within these riparian reserves.

Management within riparian reserves must demonstrate how activities will maintain or benefit riparian reserves and meet the Aquatic Conservation Strategy objectives. Designing projects that

result in a substantial loss of large wood also reduces available material that can provide valuable stream channel structure. Also, the harvesting large timber can negatively impact water quality and riparian habitat. None of these scenarios meet the intent of the Northwest Forest Plan or ACS objectives. The Northwest Forest Plan recognized the need to manage within riparian reserves to address legacy issues of old silvicultural practices that encroached or even eliminated large trees within riparian areas and adjacent stream channels such as in plantations (LRMP, IV-110, IV-49). Silvicultural activities within riparian reserves must encourage the growth of larger trees to accelerate cover, shade and large woody debris necessary for stream channel structure and sediment routing. Silvicultural practices must maintain or benefit riparian areas and therefore any treatments must leave the largest trees intact and thin out smaller trees that result in excess stand densities, high fuel loads, and retard the recovery of the native timber 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 small diameter trees from the outer portions of riparian reserves would result in very low levels of ground disturbance while still adequately thinning the stand for the purpose of improving the health of vigor of the residual trees. The inner portion of riparian reserves will remain undisturbed ground would provide a more than adequate buffer to protect water quality from sedimentation.

Riparian reserves in the project area have been heavily altered due to past timber harvesting (see Table 23). About 3% of all treatment acres in riparian reserves are natural stands, the rest are plantations. Most riparian reserves in treatment units are plantations, pole/shrub stages or early mature stages of development. About 28% of riparian reserves designations overlap areas in the mid mature seral stage of development. These areas generally coincide with the shaded fuel break locations. Only hand applied fuel reduction treatments are proposed in these units because mid mature and older seral stages tend to be more resilient to wildfire and do not respond as vigorously to thinning from below treatments.

Proposed treatments in riparian reserves are also designed to accelerated recovery or re-growth 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 ecosystem function which provides in-channel structure for fish and wildlife habitat and suitable material for sediment routing. Past timber management practices have reduced the potential for large woody debris recruitment in many of the headwater streams within the project areas.

A comparison of the measurable indicators for assessing potential impacts to riparian reserves by alternatives is shown in the Table 24 below.

Table 24– Riparian reserve proposed treatments and acres of large woody debris recruitment potential

Alternative	Treatment Type (acres)					Large Woody Debris Recruitment Potential from Proposed Treatments
	Commercial Thinning	Shaded Fuel Breaks	Jeffery and Sugar Pine Restoration	Pre-Commercial Thinning	Timber Stand Improvement	
No Action	0	0	0	0	0	0
Proposed Action	62	118	17	15	111	323

Alternative 1 – No Action

Direct and Indirect Affects

Under this alternative there would be no management within riparian reserves and therefore no potential for direct and indirect effects associated with ground disturbing activities (see Table 24). An indirect effect of not managing in riparian reserves within established 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 stand 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, cover and delay the recovery of LWD recruitment potential, not to mention the significantly increased potential for sediment delivery.

Cumulative Effects

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

Alternative 2 – Proposed Action

Direct and Indirect Affects

Under this alternative, proposed treatments in riparian reserves would occur (Table 24). 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 (less than 62 acres of endlining and cable yarding) that the small quantity of sediment that might be delivered to these intermittent and ephemeral streams would ever be detectable or have any measurable effect compared to the natural background levels of sediment delivery. Adverse impacts 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 (especially 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 will provide better shade, cover and future large woody debris, more diverse riparian vegetation)

This alternative includes approximately 261 acres of "hand" treatments in riparian reserves. Hand treatment operations are typically conducted by using chainsaws, weed-eaters with cutter heads, loppers, pole pruners, for example. This type of treatment can also include the use of fire to reduce fuels/or to reduce or enhance riparian vegetation. These hand treatments would have little to no risk of sedimentation of adjacent stream channels.

Underburning and/or firing would be done by backing the fire down the slope to maintain lower flame lengths, generally less than 4 feet high. Ignition would stop at the edge of the riparian reserve and the fire would be allowed to slowly back down and go out on its own (but no closer than 50 feet or to the break in slope). The intentional ignition of fuels within riparian reserves would be limited to only those instances where ignition is needed to lessen fire intensity and subsequent damage to the residual stand. These design features insure is a low risk of sedimentation as a result of underburning or firing.

Table 24 shows which units will have wood extraction to reduce fuel loads and 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, 2/ the total acres of endling is so small relative to the total acres treated that the amount of potential sediment delivery is extremely limited in size and distribution, and 3/ heavy equipment is excluded from the entire Riparian Reserve width (160 feet).

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 and cable yarding would greatly benefit reducing the high fuel loads within these riparian areas and return the riparian areas to more natural vegetation conditions and allow more true riparian vegetation to re-establish. Selective thinning through hand, endline and cable yarding treatments in designated riparian reserves would greatly benefit and facilitate the re-establishment 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 Aquatic Conservation Strategy objectives. Under this alternative, approximately 62 acres of riparian reserves will benefit from selective thinning through increase recovery and growth of conifers that will 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' slope distance whichever is greatest. The site-potential tree height for this project was determined to be at 160 feet. 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 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 Gordon-Hill project design criteria provide a solid foundation that will protect riparian processes and functions, water quality and riparian dependent species.

Management within riparian reserves must demonstrate how activities will maintain or benefit riparian reserves and meet the ACS objectives (see water quality section for more details on meeting ACS objectives). 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 issues of old silvicultural practices that encroached or even eliminated large trees within riparian areas and adjacent stream channels (LRMP, IV-110, IV-49). Silvicultural practices must maintain or benefit riparian areas and therefore any treatments must leave the largest trees intact 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 undisturbed ground would provide more than adequate buffer to protect water quality from sedimentation.

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 Aquatic Conservation Strategy (ACS) objectives are met (LRMP, IV-46). The Forest Plan further recognizes the need to apply silvicultural practices within riparian reserves to control stocking and re-establish and manage stands and acquire desired vegetation characteristics needed to attain ACS objectives (LRMP, IV-49).

Cumulative Effects – Proposed Action

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 written in greater detail in the Gordon-Hill Cumulative Effects Analysis – Appendix A. The timeframe for the analysis is the past 30 years and into the future 10 years. The figure below displays the watershed cumulative effects boundaries.

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 results 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.

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

Cumulative Watershed Effects Methodology

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 written in greater detail in the Gordon-Hill Cumulative Effects Analysis – Appendix D. The timeframe for the analysis is the past 30 years and into the future 10 years. The figure below displays the watershed cumulative effects boundaries.

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 results 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.

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

Spatial and Temporal Scope of Cumulative Watershed Analysis

All watersheds affected by the project were assessed for cumulative watershed effects (Figure 3 and Table 26). All past, present, and reasonably future management activities were assessed which include timber harvest activities, existing roads, and road improvements on both private and public lands. Timber harvesting activities dating back to the late 1970’s were considered in the CWE analysis. Recent wildfires and County Road improvements within the project area were also included.

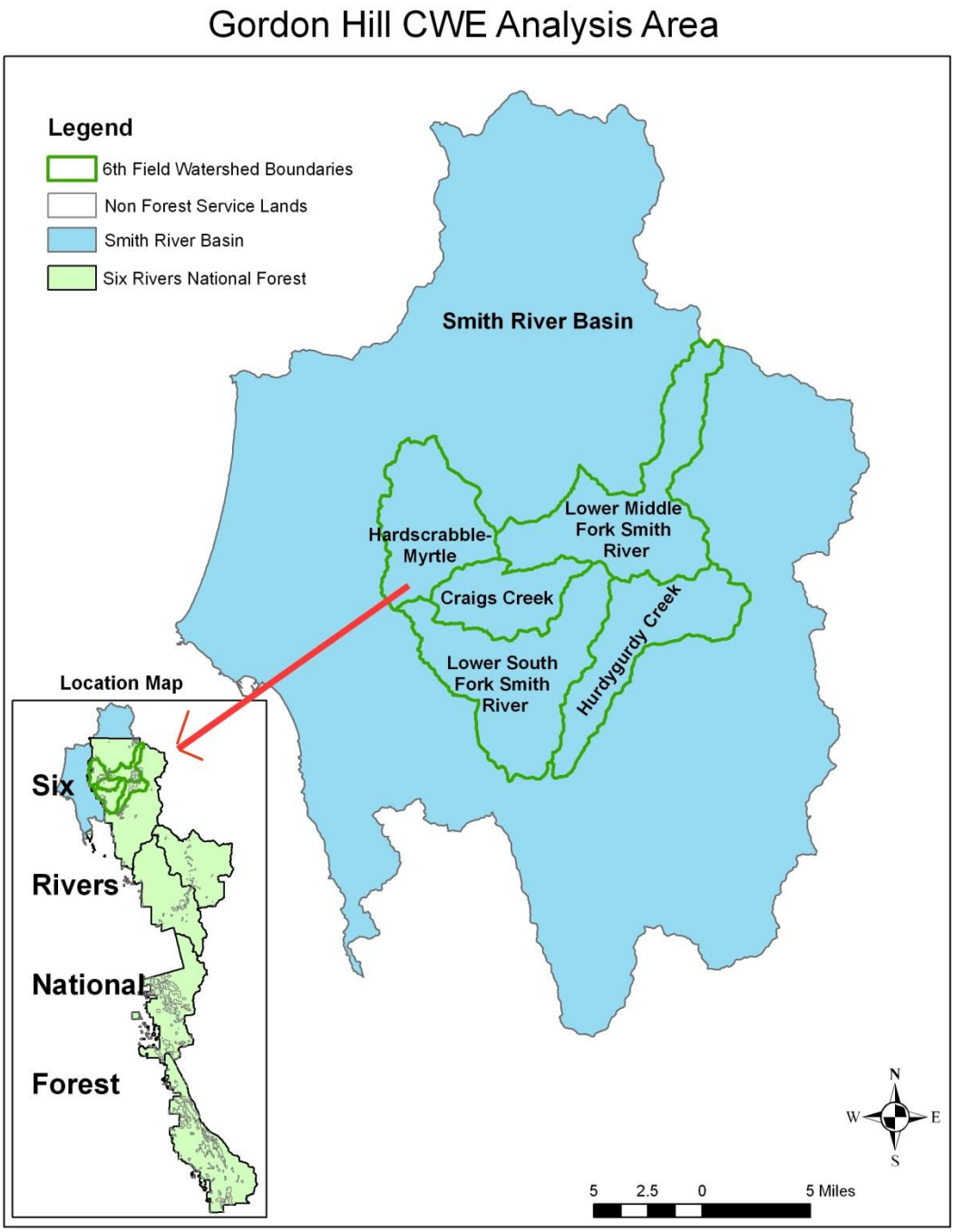


Figure 3 – Gordon Hill project CWE Analysis Boundary

Beneficial Uses and Key Physical and Biological Parameters

There are many beneficial uses of water within the South Fork Smith River 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 illegal OHV

use can have impacts to water quality. However, there is no active mining within the affected watersheds and the extent of unauthorized OHV use is limited due to the steepness of the surrounding terrain.

Cumulative Watershed Effects ERA Model:

In order to determine the potential for the implementation of the proposed action to result in added cumulative effects, the extent of road miles and acres of timber harvest, including wildfires, within all affected watersheds, including private land activities, were tallied. CWE's were assessed using the Region 5 Equivalent Roaded Acres (ERA) Model. This model is designed to be an initial red flag for earth scientists to determine whether or not past and present land management activities in a given watershed approach or exceed a threshold of concern (TOC). 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. The 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.

Table 25 – Affected Watershed Areas

6th Field Watershed	Watershed Acres
Craigs Creek	11,493
Hardscrabble-Myrtle	17,784
Hurdygurdy Creek	19,124
Lower Middle Fork Smith River	27,288
Lower South Fork Smith River	27,542

Table 26 - Cumulative watershed effects and ERAs compared to the threshold of concern.

6thField Watershed	Current Condition (past activities)	Proposed Action	Future Actions	Total Percent ERAs	Threshold of Concern (% TOC)
Craigs Creek	424 (3.7%)	163 (1.41%)	-33	554 (4.8%)	10%

Hardscrabble-Myrtle	624 (3.5%)	16 (.09%)	-62	578 (3.2%)	10%
Hurdygurdy Creek	355 (1.9%)	34 (0.18%)	-12	377 (2.0%)	11.9%
Lower Middle Fork Smith River	687 (2.5%)	13 (less than 0.00%)	-48	652 (2.4%)	10%
Lower South Fork Smith River	460 (1.7%)	50 (0.18%)	-55	456 (1.7%)	11.6%

Cumulative Watershed Effects
Field investigations within the project area revealed little legacy impact from previous timber harvest activities. There has been no harvest-related sediment delivery from new or enlarged landslides on Forest Service land in this watershed since 1975 and there has been no new permanent road construction in the project area since 1998. Possible future actions in the project area that may affect the total ERA is the implementation of the Smith River NRA Road Restoration and Motorozed Travel Management EA. The proposed action, when implemented, decommissions/removes approximately 46 miles of existing road in the project watersheds. These miles were subtracted from the total project ERAs for all affected watersheds (see Table 26).

The CWE ERA analysis reveals that none of the watersheds are over a threshold of concern. Review of project files and field reconnaissance confirm there are no adverse direct or indirect effects to beneficial uses of water in the area affected by the proposed action. Based upon analysis of direct, indirect and cumulative effects, the proposed activities will result in a minor short-term impairment to water quality conditions. 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 will not result in *cumulative watershed effects* that threaten impairment long-term water quality objectives. Recovery of soil surface cover will 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. R1-2010-0029).

Fisheries and Aquatic Resources

Introduction

Management of aquatic dependent species and habitat, and maintenance of a diversity of animal communities, is an important part of the mission of the Forest Service (Resource Planning Act of 1974, National Forest Management Act of 1976). Management activities on National Forest System (NFS) lands must be planned and implemented so that they do not jeopardize the

continued existence of threatened or endangered species or lead to a trend toward listing or loss of viability of Forest Service Sensitive species. In addition, management activities should be designed to maintain or improve habitat for Management Indicator Species to the degree consistent with multiple-use objectives established in each Forest LRMP.

Direction relevant to the proposed action as it affects aquatic biota includes:

Endangered Species Act (ESA) The Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that any action authorized by a federal agency not be likely to jeopardize the continued existence of a threatened or endangered (TE) species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA, as amended, requires the responsible federal agency to consult the USFWS and the National Marine Fisheries Service concerning TE species under their jurisdiction. It is forest service policy to analyze impacts to TE species to ensure management activities are not be likely to jeopardize the continued existence of a TE species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. This assessment is documented in a Biological Assessment (BA) and is described in detailin this Chapter.

Forest Service Manual and Handbooks (FSM/H 2670) - Forest Service Sensitive (FSS) species are plant species identified by the Regional Forester for which population viability is a concern. The Forest Service develops and implements management practices to ensure that rare plants and animals do not become threatened or endangered and ensure their continued viability on national forests. It is forest service policy to analyze impacts to sensitive species to ensure management activities do not create a significant trend toward federal listing or loss of viability. This assessment is documented in a Biological Evaluation (BE) and is described in detail in this Chapter.

Smith River NRA Act

Section four of the Smith River NRA Act of 1990 describes the purpose of the Smith River NRA - For the purposes of ensuring the preservation, protection, enhancement, and interpretation for present and future generations of the Smith River watershed's outstanding wild and scenic rivers, ecological diversity, and recreation opportunities while providing for the wise use and sustained productivity of its natural resources, there is hereby established the Smith River National Recreation Area.

Six Rivers National Forest Land and Resource Management Plan

The Six Rivers National Forest Land and Resource Management Plan (LRMP) outlines management direction related fisheries and aquatic resources. The proposed action is consistent with the LRMP management direction for the project area.

<u>Aquatic and Riparian Ecosystems</u>

Pages IV-106 through IV-111 of the LRMP includes direction for managing and protecting aquatic and riparian ecosystems, with specific Standards and Guidelines (S&G) for managing

roads and vehicle access to protect fisheries and other aquatic biota, water quality, and riparian vegetation. Also included in this section of the LRMP is the direction for Key Watersheds. As part of the Northwest Forest Plan Aquatic Conservation Strategy, Key Watersheds are intended to provide a system of large refugia that are crucial to at-risk fish stocks and provide high water quality. Relevant facets of managing Key Watersheds are included in this section, including the specific requirement of "no net gain" in road miles. Forest S&G 9-17 (page IV-111) states that Watershed restoration should focus on removing and upgrading roads. The Smith River basin is designated as a Key Watershed. The RMRD project will reduce road miles across the District. There will be no net gain in road miles.

Aquatic Conservation Strategy (ACS)

The ACS is intended as a means to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. The strategy would protect salmon and steelhead habitat on federal lands managed by the FS and BLM within the range of the northern spotted owl.

In order to make the finding that an action "meets" or "does not prevent attainment" of the objectives, the analysis must include a description of the existing condition, a description of the properly functioning range of natural variability of the important physical and biological components of a given watershed, and how the proposed project or management action maintains the existing condition or moves it toward the properly functioning range of natural variability. Management actions that do not maintain the existing condition or contribute to improved conditions in the long-term would not meet the intent of the ACS and thus, should not be implemented.

The four components of the ACS are Riparian Reserves; Key Watersheds; Watershed Analysis; and Watershed Restoration. Implementation of these components operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. These four components are integral to the development, design, and implementation of projects in order to ensure consistency with ACS objectives. The following discussion addresses how each of these components relate to the proposed action.

Riparian Reserves: Riparian reserves are portions of watersheds where riparian resources receive primary emphasis and where special standards and guidelines apply. Riparian areas are the portion of the Riparian Reserve nearest the water. Standards and guidelines prohibit and regulate activities in riparian reserves that retard or prevent attainment of the ACS objectives.

Key Watersheds: A system of Key Watersheds that serve as refugia is crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. These refugia include areas of high quality habitat as well as areas of degraded habitat. Key Watersheds with high quality conditions will serve as anchors for the potential recovery of depressed stocks. Actions within Key Watersheds would be implemented in a manner consistent with guidance for management within these areas. The intent of activities in these areas would be focused on recovery of Pacific salmonids. Actions designed to reduce the negative effects of the

existing infrastructure on aquatic habitats and habitat restoration is emphasized within Key Watersheds.

Standards and Guidelines for Key Watersheds

a. Inside Roadless Areas - This project does not contain activities that construct roads within IRAs.

b. Outside Roadless Areas - This project does include route activity within IRAs.

c. Key watersheds are highest priority for watershed restoration – As displayed in the baseline and effects to indicators sections below, the proposed action would be completed in the Smith River key watershed. All indicators would be maintained due to the level of no effect from the proposed action and concurrent activities on non-USFS roads and on adjacent private lands (see cumulative effects discussion).

d. Watershed analysis is required prior to management activities, except minor activities such as those Categorically Excluded under the National Environmental Policy Act – All watersheds within the analysis area have had watershed analysis completed.

e. Watershed analysis is required prior to timber harvest - This project does propose harvest of standing timber.

Watershed Analysis
Watershed Analysis plays a critical role in providing for aquatic and riparian habitat protections. It is one of the principal analyses that is used in making decisions on implementation of the ACS. Watershed analysis is required in Key Watersheds, for roadless areas in non-Key Watersheds and Riparian Reserves prior to determining how proposed land management activities meet the ACS objectives. Watershed Analyses have been completed for the entire Smith River basin.

Watershed Restoration
Watershed restoration is an integral part of a program to aid recovery of fish habitat, riparian habitat, and water quality. The proposed vegetation and fuel treatments are consistent with watershed analysis findings.

Aquatic Conservation Strategy Objectives
The Proposed action alternatives all meet or do not prevent attainment of the following ACS objectives:

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.

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.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations;

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;

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;

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;

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

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 distribution of coarse woody debris sufficient to sustain physical complexity and stability;

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

Effects Analysis Methodology

This analysis of effects and environmental consequences to aquatic biota and their habitat uses a standardized set of indicators developed from the Northwest Forest Plan and adopted by the USFS and NMFS. Indicators are those identified in the methodology Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale (NMFS 1996).

The indicators are used to determine effects to aquatic biota, and if any of the action alternatives (or their components) “meets” or “does not prevent attainment” of the objectives of the ACS. This indicator analysis method describes the existing baseline condition (summarized by indicator in a “matrix”), including the properly functioning range of natural variability of each indicator, and how the project maintains the existing condition or moves it toward the properly functioning range of natural variability.

Data Sources:
Assessment of environmental baseline and use of indicators and pathways follows Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale (NMFS 1996). Information regarding fish habitat baseline conditions of Smith River tributaries within or adjacent to the project area is derived primarily from these sources: 1) SRNF fish surveys habitat inventories (including Level II surveys from Siskiyou Research Group and the Smith River Alliance) for Hurdygurdy, Craigs, Coon, Gordon, Jones, and Cant Hook Creeks, and Middle and South Fork Smith River, 2) stream survey reports from the California Department of Fish and Game, 3) the Fox Unit Monitoring Fishery Reports for upper South Fork Smith tributaries (USFS 1976 through 1985), and 4) the Smith River Ecosystem Analysis (McCain et al. 1995).

Analysis of watershed and road conditions (and effects) is based on *Road Assessment and Restoration Planning in the Smith River Basin* (Ledwith 2003a, Ledwith 2003b). These analyses address current and potential sediment sources, road density and location, drainage network increases, and effects from road drainage features such as stream crossings; and use methods outlined in the *Assessment and Implementation Techniques for Controlling Road-Related Sediment Sources* (Hagans and Weaver, 1997), *Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings* (Flanagan *et. al*, 1998)

Watershed condition data were also compiled from *Rating Watershed Condition: Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region* (USDA Forest Service, Draft 2.4, April 2000). This report was part of a regional USFS effort to evaluate watershed condition and identify effects. Watersheds were delineated at the 5th field scale for National Forest Lands, which includes all of the Smith River NRA and Gasquet District lands. The following watershed information is general to the entire action area. More specific watershed data is included for project activities in close proximity to coho salmon CH.

Aquatic Biota Habitat Indicators:

Indicators are those identified in the methodology *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996). This indicators are grouped according to pathways as follows:

WATER QUALITY
- Temperature
- Sediment/Turbidity
- Chem. Contam/Nut

HABITAT ACCESS
- Physical Barriers

HABITAT ELEMENTS
- Substrate
- Large Woody Debris
- Pool Frequency

Pool Quality
Off-channel Habitat
Refugia

CHANNEL CONDITION & DYNAMICS
Width/Depth ratio
Streambank Cond.
Floodplain Connectivity

FLOW/HYRDOLOGY
Peak/Base Flows
Drainage Network Increase

WATERSHED CONDITIONS
Road Density & Location
Disturbance History
Riparian Reserves

EXISTING ENVIRONMENT

The Smith River is well known for its inherent clarity and low turbidity. Turbidity levels are very low and are reflective of the hard ultramafic rock and coarse parent material, and the subsequesnt coarse substrate that dominates streams of the Smith River basin. Turbidity data has been recorded during storms following wildfire - an indication of the expected level of ash delivered from hillslopes into channels during storms. One of the highest turbidity readings for the Smith basin was observed in November 16, 2002 during the first major storm that followed the Biscuit Fire of 2002, where turbidity (presumably from ash runoff) peaked at 74 turbidity units at 8:45 pm. The turbidity dropped back to 8 by 8:00 pm the following day. The stream maintains a low turbidity level during a very high storm flow (>100 year return interval) and recovers very quickly from a large pulse of wildfire ash.

Water temperature in mainstems of the Smith River is beneficial to TES fish, and ranges from 5 degrees C in winter (in tributaries) to 23 degrees C in late summer (40 to 75 degrees F) (USFS 1976 to 1985). Due to the proximity to the coast and the maritime rain precipitation patterns, stream temperatures rarely approach the freezing piont. Shade is provided mainly by red alder, bigleaf maple, Douglas-fir, incense cedar, and Port-orford cedar. Some dense shading from redwood occurs in the western part of the project area. In the anadromous reaches of the Smith River, shade canopy ranges from 20 to 83 percent (USFS 1976 through 1985). The range in water temperature in the Smith River is properly functioning.

The road system directly affects riparian communities where it impinges on riparian areas. Roads can indirectly affect riparian communities by intercepting surface and subsurface flows and routing these flows so that riparian areas dry up and the riparian vegetation is replaced with upland vegetation. Riparian plant communities play a vital role in providing shade. Removal or degradation of these communities can affect stream stability and water temperatures, which in turn, affects aquatic habitat.

The condition and function of the riparian reserves varies throughout the project area. Functions provided by the riparian reserves that are important for aquatic TES species include shade canopy, large woody debris (LWD) production from the mortality and recruitment of mature trees, protection of small floodplains important for overwintering habitat, and production of nutrient and food sources. As described above, the shade canopy is currently adequate to maintain stream temperatures within the range necessary for productive salmonid habitat.

The following fish species are known to occur in the project area (Fuller 1995, McCain 1994). See the Forest-wide Reference Document dated September, 2013 for species life history information.

Federally Threatened, Endangered, or Proposed Species

Coho Salmon (*Oncorhynchus kisutch*) Southern Oregon/Northern California Coasts (SONCC) Evolutionary Significant Unit (ESU), and designated Critical Habitat.
Status: Federally Threatened

Both historical and recent abundance trends have been described by NMFS in their coast-wide status review (Weitkamp et al. 1995, pgs. 110-111). Although data is limited for this ESU, the status review made the following summary:

Most of the information for the northern California region of this ESU was recently summarized by the California Department of Fish and Game. They concluded that "Coho salmon in California, including hatchery stock, could be less than 6 percent of their abundance during the 1940's, and have experienced at least a 70 percent decline in numbers since the 1960's." They also reported that coho salmon populations have been virtually eliminated in many streams and that adults are observed only every third year in some stream, suggesting that two or three brood cycles may already have been eliminated.

An "Updated Status of Federally listed ESUs of West Coast Salmon and Steelhead" (including coho salmon) was completed in June 2005 (Good *et al.* 2005). The status update included limited new information for coho salmon. In the status update, the BRT stated that, "None of these data contradict the conclusions the BRT reached previously, nor do any data (1995 to present) suggest any marked change, either positive or negative, in the abundance or distribution of coho salmon within the SONCC ESU."
NMFS describes coho salmon within the Smith River basin as a functionally independent population (Williams et al. 2006). Functionally independent salmon populations can serve primary roles in salmon ESU recovery. Coho salmon in the Smith River basin primarily occur in tributaries of the lower mainstem, particularly Mill Creek and Rowdy Creek. Coho salmon occurrence in the Smith River NRA has been low over the past 30 years, as indicated by annual spawning and juvenile fish surveys since 1976. Adult and juvenile coho are not observed in survey reaches on the NRA every year, but rather sporadically. Spawning and juvenile coho have been observed sporadically in the low gradient and gravel-rich reaches of large 6th order tributaries of the North, South, and Middle Forks Smith River, including Hurdygurdy, Patrick, and upper North Fork Smith. Juvenile coho were observed in Hurdygurdy and Patrick Creeks in

1991, and recently in the upper South Fork Smith in 2012 and 2013 and North Fork Smith (outside the NRA) in 2012 and 2013. The Gordon Hill project does not contain and is not in proximity of SONCC coho salmon CH or Chinook salmon EFH.

Critical Habitat (CH): NMFS designated CH for SONCC coho salmon on May 5, 1999 that encompasses coho-accessible reaches of all rivers (including estuaries and tributaries) between Cape Blanco, Oregon and Punta Gorda, California. Analysis of SONCC coho CH on the SRNF is based on known or suspected coho habitat found within a watershed. CH excludes reaches located above longstanding natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). SONCC coho CH is derived from available historical fish species inventories, and habitat assessments on record at the Six Rivers National Forest Supervisor's Office (SO).

Essential Fish Habitat (EFH): The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) set forth a number of new mandates for NOAA Fisheries, regional fishery management councils, and federal action agencies to identify and protect important marine and anadromous fish habitat. Effects to EFH related to this project were analyzed using habitat defined by the SRNF as known or suspected coho and chinook habitat. EFH for coho and chinook were derived from available historical fish species inventories, and habitat assessments on record at the SRNF SO.

Forest Service Sensitive Species

Steelhead (*Oncorhynchus mykiss*) Klamath Mountain Province (KMP) ESU
Chinook salmon (*Oncorhynchus tshawytscha*) Southern Oregon/Northern California Coastal (SONCC) ESU
Coastal cutthroat trout (*Oncorhynchus clarkii*) Southern Oregon/ California Coasts (SOCC) ESU

Aquatic Biota Habitat Indicators – Baseline Conditions

Water Quality

Water Temperature: properly functioning

Water temperature in the project area ranges from 5 degrees C in winter (in tributaries) to 23 degrees C in late summer (in mainstems) (USFS 1976 to 1985). Due to the proximity to the coast and the maritime rain precipitation patterns, stream temperatures rarely approach the freezing piont. Shade is provided mainly by red alder, bigleaf maple, Douglas-fir, incense cedar, and Port-orford cedar. Some dense shading from redwood occurs in the western part of the project area. In the anadromous reaches of the Smith River, shade canopy ranges from 20 to 83 percent (USFS 1976 through 1985). The range in water temperature in the Smith River is properly functioning.

Turbidity: properly functioning

The Smith River is well known for its inherent clarity and low turbidity. Turbidity levels are very low and are reflective of the hard ultramafic rock and coarse parent material, and the subsequent coarse substrate that dominates streams of the Smith River basin. Information is available for sediment related turbidity during storms. For Hurdygurdy Creek, the highest turbidity recorded that is on record is 5.5 (Hach FTU) on 14 January 1980. This was at a flow of 1600 cubic feet per second (cfs) and a suspended sediment load of 157 milligrams per liter (USFS 1980).

Turbidity data has also been recorded during storms following wildfire - an indication of the expected level of ash delivered from hillslopes into channels during storms. One of the highest turbidity readings for the Smith basin was observed in November 16, 2002 during the first major storm that followed the Biscuit Fire of 2002, where turbidity (presumably from ash runoff) peaked at 74 at 8:45 pm. The turbidity dropped back to 8 by 8:00 pm the following day. Since the stream maintains a low turbidity level during a very high storm flow (>100 year return interval) and recovers very quickly from a large pulse of wildfire ash, turbidity can therefore be assumed to be properly functioning.

Sediment: at risk

Management-related sources of sediment exist primarily in the form of road prisms and stream crossings. Crossings are predominantly corrugated metal culverts buried within channels with earthen fills. Stream crossing fills present the most concern since the fills are currently within channels, and in several cases have the potential for stream diversions or are beginning to cause impacts due to crossing failure. Nearly 50% of the stream crossings are in need of routine maintenance. Cross drains and erosional features on roads (gullies, rills, road prism and bank failures) are also sources of sediment.

Mass wasting can be a primary determinant of fine sediment sources. The sensitivity of an area to mass wasting depends on the interaction of the soils and underlying bedrock, slope steepness, and the subsurface hydrology. Much of the project area is characterized as steep, mountainous terrain. Road-related mass wasting can be attributed to 1) improper placement and construction of road fills and stream crossings, 2) inadequate culvert sizes to accommodate the peak flows, sediment loads, and woody debris, 3) roads located on soils susceptible to mass wasting, and 4) water diversion onto unstable hillslopes. Road-related mass wasting potential is determined by examining the miles and density of roads located on unstable geologic rock units (Table 27 and 28).

Table 27. Smith River NRA and Gasquet District Mass Wasting

Analysis Watershed Name	Mass Wasting Potential
Middle Fork Smith	High Hazard
South Fork Smith	Moderate Hazard

Table 28. Criteria for Mass Wasting Ratings

Rating	Definition
High Hazard	Watersheds characterized by the presence of a large number of roads on unstable geologic types. This results in a situation where it is very likely that the timing, geographic distribution, and magnitude (total volume) of natural land sliding has been significantly altered.
Moderate Hazard	Watersheds characterized by the presence of a moderate number of roads on unstable geologic types. This results in a situation where there is a moderate risk that the timing, geographic distribution, and magnitude (total volume) of natural land sliding has been significantly altered.
Low Hazard	Watersheds characterized by the presence of very few, if any, roads on unstable geologic types. This results in a situation where the natural sediment regime is likely to be intact, and it is very unlikely that roads have, or will, significantly modify the timing, geographic distribution, and magnitude (total volume) of natural land sliding in the watershed.

Middle Fork Smith sub basin (including Myrtle-Hardscrabble)

Within the Middle Fork Smith subbasin, 108 roads have either a stream crossing, cross drain, or erosional feature for a total of 829 features. Crossing types in the subbasin are diverse with 357 (82%) fitted with corrugated metal culverts, 44 (10%) fords, 21 (5%) Humboldt crossing and 13 (3%) bridges. Eighty four stream crossing sites (19%) were identified as high, 208 (48%) as medium, and 145 (33%) low priority. High and medium priority stream crossings could potentially be a source of approximately 231,866 cubic yards of sediment.

A total of 311 cross drains exist in the Middle Fork Smith subbasin. Of these, 37 (12%) were identified as high priority. These culverts commonly have plugged inlets and directly delivery sediment to the stream network through surface flow paths (i.e., rills and gullies). These flow paths are chronic contributors of fine (i.e., silt and clay) sediment from the road surface and inboard ditches. The main cause of these flow paths is long sections of uncontrolled flow along the road surface and inboard ditch.

120 (39%) cross drains are in need of routine maintenance. The most common problem (50% of sites) is sediment plugging of the culvert inlet. Plugged cross drains can divert water either onto the road surface or hillslope causing erosion, or into downroad cross drains or stream crossings possibly causing these sites to fail. Other maintenance needs include treating buried outlets, filled inboard ditches, and broken drop inlet covers.

A total of 81 road-related erosional features have been identified in the Middle Fork Smith watershed. Types of erosional features include: 31 cutslope failures, 28 fillslope failures, and 22 roadbed failures. These sites are the source of an estimated 99,030 cubic yards of sediment that is beginning to enter the stream network.

Within the Middle Fork Smith subbasin, 248 roads (132 system and 116 non-system) have been inventoried and evaluated. A total of 437 stream crossings exist in the Middle Fork Smith watershed giving a stream crossing density of 1.7 crossings per mile of road. Road density is approximately 0.003 miles/acre. Knopki, Little Jones, and Siskiyou Fork watersheds in the upper Middle Fork area have the majority of road-related impacts. Table 29 describes the potential sediment sources existing in the Middle Fork Smith sub basin.

Table 29. Potential sediment yield from road-related sites in the Middle Fork Smith sub basin (from Ledwith 2003a).

Site Type	Total number of sites	Number of high priority sites	Number of medium priority sites	Future yield to streams (cy)	Number of sites that need maintenance	Number of sites currently diverting	Number of sites with diversion potential
Stream Crossings	437	84	205	231,866[1]	149	33	181
Cross Drains	311	37	64	N/A	120	N/A	302
Erosional Features	81	35	10	44,339[2]	N/A	N/A	N/A
Totals	829	156	279	276,205	269	33	483

[1] Includes stream crossings ranked high or medium priority. At stream crossings with diversion potential, future erosion is difficult to predict. A minimum estimate of the stream crossing fill volume was used as a predicted value for this table.
[2] Includes erosional features ranked high and medium priority.

South Fork Smith sub basin

Within the South Fork Smith subbasin, 264 roads (164 system and 100 non-system) have been inventoried and evaluated. A majority of the roads pose little risk to the stream network, with only minor evidence of past sediment delivery to streams. Only 110 (45%) of the roads have either a stream crossing, cross drain, or erosional feature for a total of 1,059 features. Of these sites, 415 (39%) need treatment for a potential sediment savings of 287,013 cubic yards.

There are 7 high priority sites between County Road 405 and road 16N03 with many sites delivering sediment to the stream system. The first half mile of 405.5 follows a perennial tributary of Hurdygurdy Creek. Within this section are two erosional features and two stream crossings that are chronic sources of sediment to the stream. The drainage system on 16N03.2 is not working adequately causing roadbed and fillslope erosion. The high priority stream crossing at mile post 0.69 is rapidly failing and may deliver the whole prism to the stream network. Treatment of these roads would result in “sediment savings” of 6,896 cubic yards. Table 30 describes the potential sediment sources existing in the South Fork Smith subbasin.

Table 30. Potential sediment yield from road-related sites in the South Fork Smith sub basin (Ledwith 2003b).

Site Type	Total number of sites	Number of high priority sites	Number of medium priority sites	Future yield to streams (cy)	Number of sites that need maintenance	Number of sites currently diverting	Number of sites with diversion potential
Stream Crossings	410	51	194	270,986[1]	175	14	146
Cross Drains	613	67	76	N/A	238	N/A	426
Erosional Features	36	17	10	16,027[2]	N/A	N/A	N/A
Totals	1,059	135	280	287,013	413	14	572

[1] Includes stream crossings ranked high or medium priority. At stream crossings with diversion potential, future erosion is difficult to predict. A minimum estimate of the stream crossing fill volume was used as a predicted value for this table.
[2] Includes erosional features ranked high and medium priority.

Chemical Contaminants and Nutrients: at risk

No known toxic chemical contaminants occur in the watershed. There is a risk of chemical contamination to streams from unrestricted motor vehicle traffic on stream banks and gravel bars at dispersed streamside recreation sites.

Recreational use of popular streamside recreation sites and the potential for water contamination from human waste has resulted in additional vault or portable toilets placed throughout the Smith River NRA in the last 5 years.

The Smith basin is at risk of not properly functioning with regard to this indicator.

Habitat Access

Physical Barriers: properly functioning

There are no known anadromous fish migrations barriers associated with any Forest Road (Six Rivers National Forest Fish Passage Survey, 2001). A few road-stream crossings have been identified as potential barriers to resident coastal cutthroat trout in the Middle Fork Smith River and Blue Creek. To what extent resident fish are affected by these possible barriers is unknown, and further analysis of these areas is a priority. In general, the location of the potential barrier is in the upper portions of the watershed and the extent to which resident fish are affected appears to be minimal.

The only artificial anadromous barrier on the Smith River was on Monkey Creek (which blocked approximately 3 miles of anadromous habitat) and was removed in 1995. No other artificial barriers exist and the stream system has approximately 300 miles of habitat accessible to anadromous fish. Therefore, the Smith basin is properly functioning with regard to habitat access.

Habitat Elements

Substrate: properly functioning

In the Smith River, sources of substrate mainly originate from natural debris, rotational, and translational landslides. Although gravel is evident in some depositional reaches of the system, such as lower Hurdygurdy and Craigs Creeks, substrate composition is very coarse and is dominated by bedrock, boulder, and cobble. The large 1964 "rain-on-snow" storm event de-stabilized logged areas and activated many landslides in the watershed, which delivered a very large pulse of hillslope debris and sediment to the channel, resulting in aggradation (Fox Unit Monitoring Fishery Reports, USFS 1976 through 1985). Smaller storms from the 1970s to the present periodically reactivated some landslides, but have also progressively downcut through the aggraded areas and have slowly routed, transported, and stored the channel sediment from the 1964 event to stable bar locations.

In depositional areas of lower Hurdygurdy, Craigs, and Coon Creeks, some of the channel aggradation is influenced by the legacy of placer and hydraulic mining that occurred in the late 1800s, which washed out coarse material from lower hillslopes and delivered material to the lower reaches.

Fine sediment (<.85 millimeter particle size) is well within the properly functioning range in most streams within the project area. Fine sediment associated with salmon spawning habitat was measured from 1976 to 1984 in Hurdygurdy Creek (a primary salmon spawning area) and ranged from 3.5% to 5% (USFS 1976 to 1985). A fine sediment percentage of 20% has been documented as a threshold where salmon egg mortality begins to greatly increase (Reiser and Bjornn 1979, Bjornn and Reiser 1991). These data indicate that in depositional features such as gravel bars (i.e. spawning habitat) where fine sediment can accumulate and have a defined impact, the level of fine sediment is very low and the Smith basin is properly functioning with regard to substrate.

Large Woody Debris: at risk

Large wood availability in the Smith River have been at low levels for at least the past 5 decades (CDFG 1963, 1972, 1978; USFS 1991). Much of the large woody debris (LWD) is above the bank full channel and potentially functions during high flow periods. This distribution of LWD is characteristic of the Smith River basin and due in large part to the intensity of storm events and associated flow responses, and to the predominance of steep confined stream reaches that prevent LWD from accumulating. A 1972 stream survey documented 10 LWD jams in the 12 mile anadromous reach of Hurdygurdy Creek, ranging from 67 to 13,000 cubic yards in size (CDFG 1972). Stream habitat inventories throughout the basin completed from 2001-2013 indicate that levels of large wood in many of the lower gradient reaches of large tributaries ranges from 0-3 pieces per mile.

In pools, LWD provides channel complexity and the habitat components of cover and bank stability, however these sites comprise a small proportion of the total stream area when compared to other habitat types and cover elements. Instream cover provided by LWD in pools

averages is 6%, and for riffle and run habitats is 2% (USFS 1991). Habitat surveys throughout the basin have documented very low quantities of LWD. Therefore, the Smith River basin is at risk of properly functioning with regard to LWD.

Pool Frequency: properly functioning

Pool/riffle ratio (by occurrence) ranges from 16% to 61%. The predominate pools are bedrock-formed. Pools are more abundant in the mainstems of the Middle and South Forks Smith, and in the lower reaches of primary tributaries including Siskiyou Fork, Hurdygurdy, Craigs, Coon, Gordon, and Jones Creeks. Pools generally become smaller and/or less abundant progressively upstream in the steeper channel reaches, however they are common at natural falls barriers – which can provide important cool water refugia during low flows in summer. Stream habitat inventories of these major tributaries indicate that the predominant pool-forming elements are bedrock flow obstructions, and the most common cover element is interstitial space within the coarse substrate. Given that pool formation and frequency is controlled primarily by the natural processes of scour and fill around bedrock obstructions, and that those processes have not been altered, pool frequency is therefore properly functioning.

Pool Quality: properly functioning

Due to the lack of LWD cover, the complexity of pools (e.g. amount of cover, spatial partitions, and substrate diversity) is less than what would potentially exist with more abundant LWD. This lack of complexity directly relates to the quality of pool habitats for overwintering coho salmon (Meehan and Bjornn 1991). However, this low abundance of LWD is characteristic of the Smith River basin and due in large part to the predominance of steep confined stream reaches that prevent LWD from accumulating, and the intensity of storm events and associated flow responses. The amount of LWD jams present in the project area (middle and upper reaches of the Smith basin) prior to European settlement and subsequent LWD removal may have been low compared to other basins. For example, LWD jams are non-existent in the North Fork Smith mainstem, a reach that has had no intentional removal and very low amounts of direct channel disturbance (road crossings, streamside timber harvest, etc.) All other important attributes, such as depth, temperature refugia, interstitial cover space, bedrock cover ledges, and pool volume are at their potential. Residual pool depth for most large tributaries within the project area ranges from 1 to over 7 meters. Therefore, given the overall condition of these important attributes, pool quality is best described as properly functioning.

Off-channel Habitat: properly functioning

Due to the predominant steep incised channel morphology of the stream system in the project area, abundance of off-channel habitat is low. In lower reaches of the main tributaries, backwater alcoves and edgewater type habitat comprise typically 2% of the total habitat surface area, and are commonly associated with channel braids or overflow channels near gravel bars. However, in comparison to their availability, these isolated small habitats are highly utilized by newly emerged salmonids in early spring during high flows. Based on habitat inventories throughout the Smith River basin, the low amount of off-channel habitat is typical for the dominant B channel types and indicates that the stream system is controlled by rock type and

channel gradient and is therefore within the expected range (Rosgen 1994). Therefore, off-channel habitat is properly functioning.

Refugia: properly functioning

The value of the Smith River as a fish habitat refuge is high and is reflective of the overall habitat conditions in the Smith River basin. The refugia values are highlighted by the fact that the entire basin is designated as a Key Watershed under the Northwest Forest Plan. The Smith River supports all freshwater life stages of Chinook salmon, coho salmon, steelhead, and coastal cutthroat, as well as Pacific lamprey, and several species of amphibians. Any given sub basin or watershed can be expected to provide sufficient refuge habitat in the event of a large catastrophic disturbance in a nearby watershed, such as a wildfire or debris landslide. Therefore, the Smith River is assumed to be properly functioning as a fish habitat refuge.

Channel Conditions and Dynamics

Width/depth Ratio: properly functioning

Although channel aggradation is evident in some reaches, the w/d ratio is within expected ranges for typical channels in the Smith River. In depositional reaches, the average width/depth ratio of the wetted channel measured during summer flows is 6.55/1.0, and ranges from 3.18/1.0 in trench pools to 17.0/1.0 in high gradient riffles. In reaches of the Smith River system, bankfull width/depth ratio ranges from below 20 to over 50. Smith River channels are predominantly steep and relatively incised Rosgen B forms (Rosgen 1994), where the width/depth ratio is fairly resilient to changes from sediment input and flooding. Overall, the width/depth ratio is properly functioning.

Streambank Condition: properly functioning

Streambank condition can be described in terms of stability. Streambank stability data are available for South Fork and Middle Fork tributaries (measured as % reach length) and ranges from zero in steep narrow bedrock channels such as in the Middle Fork Smith, to approximately 11% of the stream channel in lower Hurdygurdy Creek where mining has occurred (Fox Unit Monitoring Fishery Reports). Portions of the Middle Fork Smith River are influenced by extensive streambank alterations from Highway 199, but have maintained high stability due to the predominance of boulder and bedrock banks. Due to the predominance of bedrock streambanks in the Smith River system, streambank condition is properly functioning.

Floodplain Condition: properly functioning

Roads can directly affect physical channel dynamics when they encroach on floodplains or restrict channel migration. Floodplains help dissipate excess energy during high flows and recharge soil moisture and groundwater. Floodplain function is compromised when roads encroach on or isolate floodplains. This can increase peak flows. When peak flows increase, more water is available for in-channel erosion, which affects channel stability. Restricting channel migration can cause channel straightening which increases the stream energy available

for channel erosion. This can also result in channel instability. Altering channel pattern affects a stream's ability to transport materials, including wood and sediment.

The project area is predominantly comprised of steep narrow canyons and valley floors, where floodplains within the bankfull level are small and localized as to their influence. However, in lower gradient reaches throughout the Smith River system, small floodplains do exist, are well connected to the channel, and are properly functioning.

Flow/Hydrology

Peak/Base Flow: properly functioning

Roads can divert surface flow, expand channel networks, convert subsurface flow to surface flow, and reduce infiltration. A channel network can be expanded by road ditches and road-related erosional features (e.g. gullies and rills), which intercept and concentrate runoff from their natural flow path. These factors may affect the overall hydrology in a watershed, particularly the quantity and timing of flow.

Reduced infiltration contributes to additional surface flow since water does not infiltrate for storage in the soil profile, but rather runs off as overland or surface flow. Storage and movement of water through the soil profile as subsurface flow regulates and sustains base flows in stream channels. When infiltration during storms is reduced, more water becomes available as surface runoff, and less water is available as subsurface. This can result in quicker, higher, and sharper stream peak flow responses to storms ("flashiness"), and lower less sustained base flows during dry periods.

Road Hazard Potential can be used to represent the potential for altered hydrologic regime (changes in runoff response) and stream diversions associated with roads. The overall condition class is determined by examining the slope position, slope gradient, proximity to stream channels, number of stream crossings, and density of the road system for each watershed (Table 31 and 32).

Table 31. Smith River NRA and Gasquet District Road Hazard Potential

Analysis Watershed Name	Road Hazard Potential
Middle Fork Smith	Moderate Hazard
South Fork Smith	Low Hazard

Table 32. Criteria for Road Hazard Potential Ratings

Rating	Definition
High Hazard	The density and distribution of roads within the watershed indicate there is a high probability that the hydrologic regime (ie., timing, magnitude, duration, and spatial distribution of runoff flows) is substantially altered. Roads within the watershed exhibit at least 3 of the following characteristics: (a) densities >0.25 miles/square mile on slope classes >45%, (b) densities >0.5 miles/square mile in

Rating	Definition
	middle and lower slope positions, (c) densities > 0.25 mile/square mile within 100 meters of stream channel (hydrologically connected), (d) > 1 stream crossing/mile of road.
Moderate Hazard	The density and distribution of roads within the watershed indicate there is a moderate probability that the hydrologic regime is substantially altered. Roads within the watershed exhibit 1 - 2 of the following characteristics: (a) densities >0.25 miles/square mile on slope classes >45%, (b) densities >0.5 miles/square mile in middle and lower slope positions, (c) densities > 0.25 mile/square mile within 100 meters of stream channel (hydrologically connected), (d) > 1 stream crossing/mile of road.
Low Hazard	The density and distribution of roads within the watershed indicate the hydrologic regime is substantially intact and unaltered. Roads within the watershed exhibit the following characteristics: (a) densities <0.25 miles/square mile on slope classes >45%, (b) densities <0.5 miles/square mile in middle and lower slope positions, (c) densities < 0.25 mile/square mile within 100 meters of stream channel (hydrologically connected), (d) (watershed average) < 1 stream crossing/mile of road.

Definitions:

Hydrologically Connected: Any road segment that, during a 'design' runoff event, has a continuous surface flowpath between any part of the road prism and a natural stream channel (any declivity in the land that exhibits a defined channel and evidence of scour and deposition) is a hydrologically connected road segment. This process uses proximity of roads to streams as a surrogate for identifying hydrologically connected roads to streams.

Hydrologic Regime: The timing, magnitude, duration, and spatial distribution of peak , high, and low flow runoff within a watershed.

Regardless of the land use history and the associated disturbance in the watershed, a significant portion of the land area is undisturbed to the point where the peak/base flow has not been measurably altered. As hillslopes, old landslide scars, and decommisioned roads continue to stabilize, it is expected that the peak/base flow response will continue to function properly.

Increase in Drainage Network: at risk

All road-stream crossings provide a point of hydrologic connectivity, but the lengths of connectivity differ at each site. Cross-drains, water bars, drainage dips, and other road drainage structures may be hydrologically connected to a channel if the diverted flow is sufficient to create a gully that leads to a stream channel. Connectivity also occurs when ditches or the road

surface deliver directly to the stream at road-stream crossings. Roads cuts with long, continuous ditch lengths can intercept ground water, route it as surface water and may locally increase peak flows during storm events. Drainage ditches that are connected to road-stream crossings provide a conduit for road-related sediment to enter stream channels.

Road-stream proximity (roads within 105 meters of stream) and road-stream density are displayed in Table 33 to indicate the extent of hydrologic connectivity within a watershed.

Table 33. Hydrologic Connectivity on the Smith River NRA and Gasquet District

Analysis Watershed Name	Road-Stream Proximity (mi/sq mi)	Crossing Density (#/sq mi)
Middle Fork Smith	0.63	1.17
South Fork Smith	0.32	0.56

Middle Fork Smith subbasin (including Myrtle-Hardscrabble)

Within the Middle Fork Smith subbasin, roads 17N08, 18N07, and 18N11 experience high traffic loads and have a combined 29 high priority sites between them which accounts for 28% of all high priority sites. These roads are chronic contributors of sediment to nearby streams with 17N08 contributing directly to Little Jones Creek and 18N07 contributing directly to Knopki Creek. Common problems on these roads include undersized culverts, plugged culverts, and roadbed gullies. Treatment of these roads would result in potential "sediment savings" of 97,969 cubic yards. Due to the current condition of roads and length of hydrologically connected road drainage features, the increase in drainage network indicator is at risk of not properly functioning.

South Fork Smith subbasin

A total of 613 cross drains have been identified in the South Fork Smith subbasin. Of these, 67 (11%) were identified as needing immediate treatment. The most common problems at these pipes were plugged inlets and direct delivery of sediment to the stream network through surface flow paths (i.e., rills and gullies). These flow paths can be chronic contributors of fine (i.e., silt and clay) sediment from the road surface and inboard ditches. The main cause of these flow paths is long sections of uncontrolled flow along the road surface and inboard ditch. In these situations, the most effective treatment is the installation of additional drainage features to reduce the road-related drainage density.

238 (39%) cross drain sites were identified as needing simple routine maintenance. The most common problem (60% of the sites) is sediment plugging the culvert inlet. Sites that plug can divert water either onto the road surface or hillslope causing erosion, or into downroad cross drains or stream crossings, expanding the drainage network and eventually causing the downstream sites to fail. Due to the current condition of roads and length of hydrologically connected road drainage features, the increase in drainage network indicator is at risk of not properly functioning.

Watershed Conditions

Road Density and Location: at risk

Road networks can impact watershed processes through surface erosion and the generation and transport of increased loads fine sediment. Surface erosion is highly dependant on soils, road surfacing, road grade, age of the road, traffic volumes, and the effectiveness and spacing of drainage structures. Studies have indicated that sediment delivery to stream systems is highest in the initial years after road construction, although unlined ditches and road surfaces with little armor can remain chronic sources of sediment.

Surface erosion condition is determined by examining the density of roads on erodible soils (Table 34 and 35). This indicator addresses the potential for altered sediment regime associated with surface erosion accelerated by road construction and road maintenance.

Table 34. Smith River and Gasquet District Surface Erosion

Analysis Watershed Name	Road Hazard Potential
Middle Fork Smith	Moderate Hazard
South Fork Smith	Low Hazard

Table 35. Criteria for Surface Erosion Ratings

Rating	Definition
High Hazard	Significant alteration of the natural sediment regime associated with surface erosion is likely or evident. Conditions are characterized by the presence of higher road densities and associated disturbance to soil and vegetation on soils highly sensitive to accelerated erosion (high - very high Erosion Hazard Ratings).
Moderate Hazard	Moderate alteration of the natural sediment regime associated with surface erosion is likely or evident. Overall disturbance is variable, with low to moderate road densities and associated disturbance to soil and vegetation on soils highly sensitive to accelerated erosion (high - very high Erosion Hazard Ratings).
Low Hazard	Minor or no alteration of the natural sediment regime associated with surface erosion is likely or evident. Overall disturbance is low and are characterized by the presence of low road densities and associated disturbance to soil and vegetation on soils highly sensitive to accelerated erosion (high - very high Erosion Hazard Ratings).

Drainage structure, function, and spacing are key to minimizing the amount of surface flow, which directly affects surface erosion. Subsequent project level Roads Analysis may consider

new cross drain spacing guidelines using the Water Erosion Prediction Program (WEPP) to model surface erosion from roads have been derived (Morfin et al., 1996). The WEPP model provides for input ranges of local climatic conditions, surfacing material characteristics, maintenance frequency, distance between cross drains, and road grade typical for National Forests. (USDA Forest Service, Water/Road Interaction Series, 1998).

Stream crossing density reflects the extent to which roads have modified the channel network and is an indicator of the potential for culvert failures. The relatively low density of road-stream crossings across the Smith River NRA is attributable to the high proportion of roads on or near ridgelines and not in frequent proximity to channels. The consequences of culvert failures can range from minor to substantial. Minor failures introduce culvert fill material that exceeds the transport capacity of the channel, causing it to become aggraded and widened. It can take several years for the channel to adjust and move the sediment downstream, but generally the effects are localized and remain within a relative short distance downstream of the crossing. Substantial failures can generate debris flows and entrain additional sediment as they progress downhill and downstream. The impacts from debris flows can extend far from the culvert failure site and take many years for the channel to adjust and riparian vegetation to reestablish. Stream crossings on steep terrain, with a lot of woody debris upstream, have the greatest potential for debris flows. Adequate road maintenance is critical in these areas.

Culvert diversions also pose significant risks in terms of off-site sedimentation. Diversions occur when a culvert plugs and the stream flow follows the roadbed instead of crossing the road and returning to the original channel. When the diverted stream flow accumulates enough water and sediment, it can create a gully and eventually cross the road and scour a new channel on the hillslope. Upgrading culvert size, increasing the number of cross drain culverts, water bars, or larger drivable surface drains (rolling dips) can minimize diversion potential.

Table 36 describes estimated road-crossing density for the District. Estimates may be actually higher or lower than predicted depending on accuracy of the stream or road coverage. The relatively low crossing density throughout the project area is attributed to the majority of roads located in the upper third of the watershed where stream density is lower. During the Smith River RAP, data on road-stream crossing density was field verified to identify specific sites and areas of concern. This included and extensive road and culvert inventory in the South and Middle Fork Smith River sub-basins (Ledwith 2003).

Table 36. Smith River NRA and Gasquet District Road-Stream Crossing Density

Analysis Watershed Name	Crossing Density (#/sq mi)
Middle Fork Smith	1.17
South Fork Smith	0.56

Portions of roads in the Smith River basin are near streams and affect flow hydrology (within 105 meters of a channel). A smaller portion of these are also within valley bottoms of stream systems. Overall road density across the Smith River basin is relatively low at approximately 1.6 mile per square mile. Therefore, the low road density that includes a portion near channels (location indicator) best describes this indicator as at risk of not properly functioning.

Disturbance History: at risk

Human disturbance history in the Smith River basin includes timber harvest and mining. Approximately 58,000 acres (FS and private) in the project are have had some form of timber management. Most of the private lands are located in the upper Hurdygurdy, Goose, and Little Jones Creek watersheds. Approximately 15% of the watershed has had some form of human disturbance, and the forest age for much of this disturbed area is less than 50 years old (early mature).

Past hydraulic mining, primarily for gold, altered certain streamchannels, including Hurdygurdy, Craigs, Coon, and Myrtle Creeks. For example, the lower 4 miles of Hurdygurdy Creek were at the heart of the Big Flat Mining District, that was most active from 1878 to 1889 and again between 1932 and 1939. This mining district encompassed approximately 1,500 acres, and contained two major ditch systems, ten hydraulic pits, numerous placers, and smaller ditches and penstock sections (USFS 1976 through 1985). Hydraulic mining altered channels and riparian areas significantly. Huge volumes of hillslope sediment were washed down to riparian and streamside areas, and LWD was removed from the channel to facilitate the mining of alluvial gold placer deposits within the substrate and near the channel. The removal of LWD reduced habitat complexity, LWD recruitment potential, and the ability of the channel to store and route the introduced sediment. Much of the landscape where hydraulic mining occurred is recovering, and previously altered riparian stands in areas like lower Hurdygurdy Creek are approaching 70 to 80 years and are beginning to provide RR functions.

This amount of disturbance history from timber harvest and mining results in the watershed to be at risk of not properly functioning.

Riparian Reserves: properly functioning

The road system directly affects riparian communities where it impinges on riparian areas. Roads can indirectly affect riparian communities by intercepting surface and subsurface flows and routing these flows so that riparian areas dry up and the riparian vegetation is replaced with upland vegetation. Riparian plant communities play a vital role in providing shade. Removal or degradation of these communities can affect stream stability and water temperatures, which in turn, affects aquatic habitat.

The condition and function of the riparian reserves varies throughout the project area. Functions provided by the riparian reserves that are important for aquatic TES species include shade canopy and thermal buffering, LWD production from the mortality and recruitment of mature trees, protection of small floodplains important for overwintering habitat, and production of nutrient and food sources. As described above, the shade canopy is currently adequate to maintain stream temperatures within the range necessary for productive salmonid habitat.

Due to the timber harvest history (described above), approximately 10% of the RRs in the project area are in an early to early mature seral stage. These RRs are predominantly within plantations or thinning areas comprised of the Douglas-fir plant series and typically range from 25 to 60

years old. Over the next 100 years, LWD recruitment potential will likely be low in these areas until they mature and develop the potential for LWD recruitment. The remaining majority (90%) of the RRs have not been managed, and range from early mature to old growth. Variation in seral stage is due to mainly to fire, windthrow, and landslides. These RRs function properly and will continue to provide shade, food, nutrients, and LWD. Therefore, the overall current RR baseline condition at the Smith River basin scale, is that RRs are properly functioning.

Table 37. Pathways and indicators for the Smith River Basin

	ENVIRONMENTAL BASELINE		
	Properly Functioning	At Risk	Not Properly Functioning
WATER QUALITY			
Temperature			
Sediment/Turbidity	turbidity	sediment	
Chem. Contam/Nut			
HABITAT ACCESS			
Physical Barriers			
HABITAT ELEMENTS			
Substrate			
Large Woody Debris			
Pool Frequency			
Pool Quality			
Off-channel Habitat			
Refugia			
CHANNEL CONDITION & DYNAMICS			
Width/Depth ratio			
Streambank Cond.			
Floodplain Connectivity			
FLOW/HYRDOLOGY			
Peak/Base Flows			
Drainage Network Increase			
WATERSHED CONDITIONS			
Road Density & Location			
Disturbance History			
Riparian Reserves			

EFFECTS OF THE PROPOSED ACTION

No Action Alternative

The No Action alternative would not change the current conditions, and would not accelerate the development of late-successional conditions in younger stands adjacent and within headwater Riparian Reserves the project area. Under the No Action alternative, no commercial or pre-commercial thinning would occur within Riparian Reserves. In addition, no shaded fuelbreak construction, or thinning-related fuel treatments would occur.

The Six Rivers Land and Resource Management Plan documented that thinning treatments of shrub, pole, and early mature stands could accelerate the development of late-mature and old growth stands by as much as 90 years. The No Action alternative could therefore delay the development of late-successional habitat in younger stands within Riparian Reserves for many decades.

The No Action alternative would also not address the fire hazard within plantations and young natural stands adjacent to Riparian Reserves. If left untreated, these stands would be a greater fire hazard in the long run because they are overstocked with many trees per acre and with dense, interlocking canopies. Treatments within these stands would reduce existing fuels. Thinning in plantations would reduce fuel accumulations from competition-induced mortality, and would improve growing conditions for the remaining trees.

Cumulative Effects of the No Action Alterative
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. Most of the riparian reserves in plantations were completely harvested (no streamside buffers). The effect of this past management was that few to no large trees remain in most plantations. The effects of these management actions have reduced large woody debris recruitment potential and elevated fuel loads within these riparian reserves. 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 results 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.

Under this alternative there would be no management within riparian reserves. 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. Without fuels reduction treatments, a wildfire in dense plantations in 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, cover and delay the recovery of LWD recruitment potential, as well as significantly increased potential for sediment delivery.

Proposed Action Alternative

A. Direct and Indirect effects

The effects of the Gordon Hill Vegetation and Fuels Management Project to salmonid species listed as threatened under the ESA and to FS sensitive salmonids are discussed together, and not to each listed/sensitive species individually, because of their similar life history and habitat requirements.

The Gordon Hill Vegetation and Fuels Management Project is designed to avoid adverse effects on anadromous fish and their habitat. Potential direct and indirect effects to fish and their habitat include: 1) shade canopy reduction (and stream temperature increases and microclimate alteration), 2) loss of large woody debris, 3) concentrations of ash entering streams following burning and impacting water quality, 4) sedimentation from bare soils resulting from thinning operations, firelines, and burning, and 5) ground disturbance and sedimentation from mechanized equipment.

Shade Canopy
Stream shade will not be reduced below 60% where it currently is greater than 60%. If less than 60% shade exists, no shade will be reduced. Reduction in canopy density to 60% may result in small local changes in adjacent terrestrial microclimate in the short term prior to remaining tree crown improvement, but will not affect to overall stream and ambient riparian corridor air temperatures.

The project design standard of a no-treatment buffer is expected to protect the existing streamside shade canopy and maintain ambient riparian and stream temperature. By maintaining a minimum 60% canopy and no-treatment buffer, microclimate and stream temperature will be maintained. Therefore, no effects on shade canopy, stream temperature, and microclimate is expected. In headwater RRs that receive thinning treatments, stream temperature and microclimate will from the thinning of suppressed canopy vegetation.

Large Woody Debris
Large woody debris (LWD) levels will be retained through project design standards. Mechanical treatments will not physically remove large woody debris, and prescribed fire will not consume any measurable amount of the current amount of large woody debris. Therefore, the proposed actions will not affect the future recruitment and amounts of LWD. In addition, the effects of thinning in young headwater RRs stands are anticipated to beneficial over the next centuries by accelerating the development of potential LWD.

Water Quality Impacts from Ash

During and after burning (understory, pile, and jackpot) the potential exists for ash to enter streams that can increase turbidity and change water chemistry. The amount of ash that results from understory burning is related to fire intensity, fuel moisture, and fuel type. In RRs, understory burning will involve low intensity surface fire that will consume surface fuels while limiting damage to the residual stand. Also, this low intensity understory burning in RRs will occur in the shade of a riparian overstory canopy and will not occur within the 50-80 ft. no-treatment buffer. Therefore, the potential for ash to enter channels from understory burning would be minimized; resulting in no effects to a stream channel .

The potential for ash entering channels from pile burning will be minimized by limiting the size of hand piles to 6 x 6 feet to keep burn intensity low. In addition, a 50 foot no-treatment fuels buffer will be maintained for both hand piles and jackpots. Therefore, limiting pile size and keeping piles at least 50 feet from channels will result in no effects from ash entering a channel.

Ground Disturbance and Sedimentation

The potential for direct sedimentation to stream channels from tree yarding is highly unlikely due to the relatively low harvest level and the proximity of proposed activities to aquatic habitats. Thinning would be beneficial to unstable RRs such as toe zones, inner gorges, and active landslide areas that are recovering from past wildfire, timber harvest or landslide events, and would not detrimentally affect slope stability.

Since fireline construction will not occur within RRs, any potential for sedimentation is highly unlikely. With regard to ground disturbance from thinning activities, an 80 foot no-treatment thinning buffer will capture and filter any generated sediment and prevent it from entering to channels. In RRs, understory burning will involve low intensity surface fire to consume surface fuels and not result in denuded soil and potential sediment. Low intensity understory burning in RRs will occur in the shade of a riparian overstory canopy and will not be within the 50 foot no-treatment fuels buffer. Therefore, any sediment generated from thinning, burning, and firelines will be captured and filtered out and not reach the stream channel.

Several studies have examined effectiveness of buffers in controlling sediments from clearcut timber harvest on forested lands. Broderson (1973) concluded that buffer widths of 15 meters (50 feet) controlled most sediment on slopes less than 50 percent and buffers of 61 meters (200 feet) were effective on extremely steep slopes. Corbett and Lynch (1985) recommended buffers of 20-30 meters (66 to 100 feet) for controlling sediments. Lynch et al. (1985) concluded that buffers of 30 meters (100 feet) removed 75 percent to 80 percent of suspended sediments draining areas that had been cleared and burned. The FEMAT Report (1993), citing these same studies, concluded that buffers of approximately one site potential tree height from the edge of the floodplain are adequate to control sediments from overland flow in most situations. Clear cut timber harvest (referenced in these studies) generally involves a relatively higher level of disturbance intensity and severity than thinning to 60% canopy, and a higher likelihood of surface erosion and sedimentation. Therefore, it is determined that for the proposed thinning and

fuel treatment actions, 50 feet would be adequate to filter and trap sediment (and retain the sediment within the buffer) and prevent any significant amount from entering watercourses and ultimately being transported downstream to fish habitat occupied by federally listed salmonids.

Ground Disturbance and Sediment from Use of Heavy Equipment Outside of RRs. The types of mechanized equipment that may be used in this proposed action include chippers, cable yarders, and excavators with cutters or masticators. Since no heavy equipment will be used in RRs no ground disturbance will occur; therefore, no direct effects are anticipated. The potential for indirect effects from activities outside of RRs is discussed in more detail below.

Use of a chipper is normally restricted to developed roads and landings, therefore effects will be restricted to road and landing use. Since BMPs and WWO will be implemented, no effects related to the use of the chipper are expected.

The cable yarder, a self-propelled track or wheeled vehicle, is also restricted to use on roads and landings due to physical limitations. Trees will be yarded with one end of the log dragging on the ground. Due to limbs suspending the tree as it is dragged, and the lightest part of the tree being on the ground, it is not anticipated that extensive yarding corridors or bare ground patches will develop. If raw earth yarding corridors do develop, they will be waterbarred and slash will be placed on the raw earth for protection. Due to implementation of PDSs, BMPs and WWO, as well as the yarding techniques used, no effects related to yarding are expected.

The track-mounted excavator with masticator arm is restricted to slopes of 35% or less and when soil moistures are less than 18%. Therefore, negligible amounts of rutting will occur when using this machine. In addition, the 30" track produces ground pressures of up to 6 psi, therefore chances of soil compaction occurring is low. The 80 foot no-treatment thinning buffers will negate the likelihood of any sediment reaching these streams.

Summary of Direct and Indirect Effects

In the short term, tree density (and 60% canopy cover) will be maintained to provide a stand density more reflective of a natural fire disturbance regime. Over the long term, canopy conditions will improve as tree crowns increase due to less competition. Heavy equipment exclusion zones will protect soil cover and provide a sediment filter buffer for stream channels. Slope restrictions (35% or less) for heavy equipment will protect slopes from erosion. Project design standards will protect headwater RRs and downstream TES fish and habitat from disturbance by maintaining shade canopy, minimizing the potential for sediment transport to streams, and maintaining potential future large woody debris sources, which are important to the function and quality of the ephemeral and intermittent RRs within treated areas.

Interrelated and Interdependent Effects

Fire risk: A short-term (less than 5 years) fuel hazard will occur with lop and scatter portion (12 acres) of the thinning and release actions. The fuels will take approximately three to four years to break down to where only the larger boles are left. If a fire occurs before the fuel breaks down, an increase in sediment may result. Depending on the size and location of the fire, this may have an effect on the fishery by removing riparian vegetation and microclimate, and set the area up for an increase in sedimentation from erosion and/or landform failure.

Chipping and mastication of activity fuels will provide a lower fire risk than lop and scatter due to the compact nature of the resulting fuels and quicker fuels decomposition. The chipped and masticated vegetation will most likely be six to twelve inches in depth and will allow much less air circulation within the resulting fuels. The compact nature of the fuels along with reduced air circulation, reduce the risk of fire starting or carrying rapidly.

Effects of Actions on Relevant Indicators

Water Quality maintain

Shade Canopy and Water Temperature: In the short term following thinning treatment in RRs, tree canopy cover will be maintained above 60%. Over the long term, canopy conditions will improve as tree crowns increase due to less competition. Therefore, there is essentially no potential for any increases in water temperature from thinning, or any of the other proposed actions. Water temperature will continue to be maintained within the range that is beneficial for salmonid growth, reproduction, egg incubation, and survival.

Sediment/Turbidity: Due to the project design standards, and the 50 ft. fuels and 80 ft. thinning sediment buffer filters along each RR, the proposed vegetation management and fuels treatments are not expected to generate or result in any sedimentation or disturbance that will be transported to channels or result in an increase in turbidity. The project will also not produce any effects that could potentially decrease turbidity. Therefore, sediment and turbidity will continue to properly function. Streams in the project area will continue to maintain a low turbidity range that allows for a high rate of success in salmonid incubation, rearing, feeding, and spawning. Percentage of fine sediment in the substrate will remain low (<12%) and will not impede spawning success, egg incubation, and fry emergence.

Chemical Contaminants: The proposed action will not result in any chemical contaminants, and watersheds will remain in their current status regarding this indicator.

Habitat Access maintain

Physical Barriers: The proposed action will not result in any change in physical barriers. Therefore, watersheds will continue in their current status with regard to habitat access.

Habitat Elements maintain

Sediment and Channel Aggradation: The 4 primary sediment sources: landslides, channel bank erosion, erosion from roads, and erosion from hillslopes, (Gallegos and Barnes, 1993) will not be altered as result of implementation of the proposed action. Thinning in RRs will maintain and protect long term large woody debris conditions that are important for metering and routing sediment in intermittent and ephemeral channels.

The potential for direct sedimentation to stream channels from tree yarding is highly unlikely due to the relatively low harvest level and the proximity of proposed activities to aquatic habitats. Thinning would be beneficial to unstable RRs such as toe zones, inner gorges, and active landslide areas that are recovering from past wildfire, timber harvest or landslide events, and would not detrimentally affect slope stability.

Since fireline construction will not occur within RRs, any potential for sedimentation is highly unlikely. With regard to ground disturbance from thinning activities, an 80 foot no-treatment thinning buffer will capture and filter any generated sediment and prevent it from entering to channels. In RRs, understory burning will involve low intensity surface fire to consume surface fuels and not result in denuded soil and potential sediment. Low intensity understory burning in RRs will occur in the shade of a riparian overstory canopy and will not be within the 50 foot no-treatment fuels buffer. Therefore, any sediment generated from thinning, burning, and firelines will be captured and filtered out and not reach the stream channel.

Due to the 50 ft. fuels and 80 ft. thinning no-treatment sediment filter buffers in each treated RR, the proposed action will not change the current amounts of natural sediment into RRs, and the other activities will not result in any sediment. Therefore, until the existing sediment sources are stabilized, and substrate becomes distributed and stored in equilibrium along the channel, the substrate indicator will be maintained in the current status.

Large Woody Debris: The proposed thinning in RRs, fuel treatments, and burning will not alter the current or future recruitment of LWD into RRs. Therefore, LWD will be maintained at current levels in each watershed. Until amounts of LWD sufficient to improve pool quality start to accumulate, much of the large woody debris will continue to occur above the bank full channel and potentially function during high flow periods. Juvenile and adult salmonids will continue to utilize these ephemeral habitats during winter storms as velocity refugia from potentially flushing flows. This proposed action will not affect how salmonids utilize LWD-associated habitats.

Pool Frequency: Pool frequency will not be altered by any of the proposed actions. Pool/riffle ratio (by occurrence) will not be impacted by this proposed action and will remain at approximately 1/3 in Hurdygurdy and Jones Creeks. Pool frequency will therefore continue to properly function. Pools at the current frequency and availability will continue to provide deep water juvenile salmonid rearing habitats, feeding areas, and adult salmonid resting and holding areas.

Pool Quality: The proposed action will not result in a change in pool quality. As described in the previous LWD section, the quality of pools (e.g. amount of cover, spatial partitions, and substrate diversity) for overwintering coho salmon will likely remain as less than optimal (Meehan and Bjornn 1991).

Off-channel Habitat: The proposed action will not affect this indicator. Off-channel habitat will continue to properly function and will not be impacted by this proposed action. This type of habitat will provide early rearing areas for newly-emerged juvenile salmonids as they feed, avoid predation, and grow.

Refugia: The proposed action will not affect refugia. Therefore, refugia will remain in their current status. The watersheds will still function to provide habitats and resources (food, water, dissolved oxygen) for salmonids in all freshwater life stages in the event of a catastrophic habitat loss in an adjacent stream, and serve as a component of a refugia network throughout the Smith River basin.

Channel Conditions and Dynamics maintain

Width/depth Ratio: Thinning in RRs, or any of the other proposed actions, will not affect width/depth ratio of adjacent or downstream fish habitat.

Streambank Condition: None of the proposed activivites will further impact streambank condition.

Floodplain Condition: None of the proposed activities will further impact floodplain condition.

Flow/Hydrology maintain

Peak/Base Flow: The proposed action would not alter any watershed processes related to natural peak/base flow (described in the baseline section), and it is expected that the peak/base flow response will continue to function properly.

Increase in Drainage Network: Due to the proposed contruction of only 0.26 miles of temporary road (on ridges that are not hydrologically conneted to a stream channel(, along with the use of previous temporary roads and landings, no change in drainage network is anticipated. However, due the extent of connectivity throughout the watershed, increase in drainage network will remain at risk at the watershed scale until larger portions of the connected road network are treated and hydrologic connectivity is reduced.

Watershed Conditions maintain

Riparian Reserves: Because of their proximity and connections to streams, ecological conditions and processes in riparian areas can strongly influence TES fish CH and EFH. Riparian areas function to provide shade, cover, and channel structural elements; supply and process nutrients; support food webs; supply substrate materials; stabilize

streambanks; filter upland sediments; and provide linkages to side channels, floodplains, and groundwater (Sullivan et al. 1987, Gregory et al. 1991, FEMAT 1993, Spence et al. 1996).

Most riparian area functions affecting streams and anadromous fish (including bank stability, shade, litterfall, large wood recruitment) occur within a distance equal to the height of a site potential tree from the edge of the streambank (FEMAT 1993, p. V-27; Spence et al. 1996, p. 216-220) for streams without a floodplain, and decline rapidly beyond that distance. Where there is a floodplain, riparian area functions may extend for a distance equal to the height of a site-potential tree from the edge of the floodplain, since during a flood the entire floodplain can function as the stream channel (Rhodes et al. 1994).

Riparian reserves are functioning properly throughout streams in the project area. The main functions provided by the riparian reserves are thermal buffering of stream temperature from shade canopy, and LWD production from the mortality and recruitment of mature trees. As described above, the shade canopy is currently adequate to maintain stream temperatures within the range necessary for productive salmonid habitat.

Due to scattered amount of previous timber harvest, there are some early mature Douglas-fir stands propsed for thinning (from 40 to 80 years old). Over the next 100 years, LWD recruitment potential will likely be low in these areas until the forest develops into a mature stage. Much of the project area includes late mature and old growth Douglas-fir series forest stands along the small headwater tributaries, with variation in seral stage is due to mainly to fire and landslides. Riparian reserves in these reaches function properly and will continue to provide shade and LWD.

Thinning within ephemeral and intermittent RRs will maintain riparian stand conditions and resilience to fire disturbance. The proposed action would protect the processes that maintain the condition and function of RRs, therefore RRs will be maintained as properly functioning.

<u>Disturbance History</u>: Due to the logging history and current road density, the disturbance history places the watersheds at risk. The proposed action will not degrade conditions regarding disturbance history. Due to the extent of human disturbance in the watershed (as high as 38% for Hurdygurdy Creek), and the location of county and state roads along valley floors and in close proximity to the Middle and South Forks Smith river, road-related disturbance will continue in close proximity to channels and the Smith River basin will continue to be at risk regarding this indicator.

<u>Road Density</u>: The proposed action will not result in an increase or decrease in road density. However, due the extent of roads throughout the watershed and the overall road density of 3 miles/square mile, road density will continue to be at risk at the watershed scale although the Smith River Road Restoration and Motorozed Travel Management Project is in progress and is proposing to decommission/resotre upt ot 46 miles of road in the planning area.

Summary of Effects to Fish Habitat Indicators

Water temperature will not be affected in the short term; however, it may decrease in the long term due to increased canopy cover as the riparian vegetation increases in size. Sediment, substrate, pool frequency and quality, off-channel habitat, floodplain connectivity, and width to depth ratio will undergo no changes as a result of implementing BMPs, WWOs, standards and guides, and the mitigation measures outlined in the PDS. Peak/base flows will undergo no change due to the construction of only 0.26 miles of ridgetop temporary road , and the amount and proximity of treatment areas in relation to stream channels. Overall, thinning and release in headwater RRs comprised of mid-mature and earlier seral stages will maintain the function and condition (including LWD recruitment), and the development of late-successional characteristics.

The proposed thinning and fuel treatment activities will not affect, change, or alter the current status of chemical contamination, physical barriers, refugia, drainage net increase, and road density/location. Chemical contamination will not occur as herbicides or pesticides will not be utilized in controlling competing vegetation or insect infestations. If any man-made barriers exist, they will not be changed with thinning and release actions. New barriers will not be created or promoted. Drainage network increase and road density/location will not change.

The changes in habitat indicators from the proposed action described above will not to translate to any direct or indirect effects to any steelhead trout, and Chinook and coho salmon. Some individual Forest Service Sensitive coastal cutthroat trout that may occupy small headwater streams may be affected, but this proposed action will not lead to a trend towards listing for this species.

Therefore, due to proximity of the project area to downstream anadromous fish habitat, no effects to steelhead, coho salmon, or Chinook salmon survival rates and spawning, incubation, rearing, feeding or migration success are likely to result from the proposed actions. Sediment will remain at natural levels and will not be sufficient to reduce downstream spawning substrate quality or impact egg survival, nor will it affect turbidity and impact juvenile salmon and steelhead feeding success and behavior. Water temperature will be maintained in the treated ephemeral and intermittent streams and will not affect dissolved oxygen or impact egg survival and juvenile fish health in streams on the Forest. Individual resident coastal cutthroat trout that may occupy headwater perennial streams in the project area may be affected, but the species will not be at risk of a trend towards listing from this project. As streamside vegetation recovers and matures in areas of past natural and human disturbance, LWD will continue to accumulate through natural recruitment processes within the treated RRs and function to store and meter sediment, as well as throughout the watershed to provide important fish habitat components.

ENDANGERED SPECIES ACT AND FOREST SERVICE SENSITIVE SPECIES DETERMINATION

Based upon the size, nature, proximity and duration of this proposed action, it is the determination of the fisheries biologist that this will not affect Southern Oregon/Northern California Coast coho salmon and its designated critical habitat, will not affect Forest Service Sensitive Chinook salmon and its essential fish habitat, and will not affect Forest Service Sensitive steelhead trout.

The proposed action may impact Forest Service Sensitive coastal cutthroat trout individuals, but will not lead to trend towards listing.

Cumulative Effects

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. Most of the riparian reserves in plantations were completely harvested (no streamside buffers). The effect of this past management was that few to no large trees remain in most plantations. The effects of these management actions have reduced large woody debris recruitment potential and elevated fuel loads within these riparian reserves. 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 results 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.

Under this alternative improvements (selective thinning) in Riparian Reserves will to encourage the growth of larger, healthier trees for the purposes of LWD recruitment potential as well as shade and cover. Fuels reduction treatments in dense plantations in riparian reserves will reduce the probably of a stand replacing fire. Fuels treatments will reduce the potential for wildfire to significantly reduce vegetation that provides shade, cover and delay the recovery of LWD recruitment potential, as well as significantly increased potential for sediment delivery. The treatments proposed will improve riparian function and meet ACS objectives.

For additional discussion of cumulative effects see Appendix D.

Wildlife

The project occurs in portions of 5 watersheds: the Lower Middle Fork Smith River (27, 270 acres), Lower South Fork Smith River (27,377 acres) Hardscrabble-Myrtle Creek (17,800 acres) Craig's Creek (11, 540 acres), and Hurdygurdy Creek (19,162 acres). The project area encompasses approximately 42,724 acres within these watersheds.

The objective of the proposal is both short- and long-term in its aim. The short-term aspect is to manage for protection from stand-replacing fire and prevent further habitat fragmentation. The long-term aspect is to restore and improve the function of habitat for late-successional and old growth associated species such as the northern spotted owl (NSO).

Vegetation within the Gordon Hill Project is described in terms of vegetation series and seral stage (Smith River Watershed Analysis and LSR Assessment 1995c). Seral stages are based on size class, age, and structure. Plant series and seral stages have been identified that best provide late-successional forest structure, function, and processes. Generally, the late-mature and old-growth seral size classes contribute most to late-successional species. The mid-mature seral size class also contributes to late-successional species, but while it may provide adequate tree size (usually greater than 21" DBH) and canopy closure it may lack some structural components (deformed trees, large logs) necessary to provide habitat. The shrub, pole, and early-mature seral stages lack all late-successional characteristics.

Approximately half of the project occurs in a Late-Successional Reserve (LSR), specifically LSR 303. The Smith River National Recreation Area Late-successional Reserve Assessment (LSRA, 1995) determined that this area of the LSR was deficient in late-successional habitat. Portions of the LSR were previously harvested, therefore, extensive stands of dense plantations exist that not only create a fuels hazard, they also do not provide suitable habitat for late-successional species such as the northern spotted owl (NSO). Plantations and young natural stands are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. Young stands have the potential to achieve rapid diameter and height growth with thinning treatments. Silvicultural prescriptions can be applied to younger stands in order to accelerate their development toward late seral conditions. These treatments could increase the amount of late seral vegetation sooner than would occur naturally. The LSRA indicated the proposed area needs extensive fuels treatments to protect the LSR as well as extensive habitat restoration.

On June 28, 2011, the U.S. Fish and Wildlife Service (USFWS) released the *Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina)*. The purpose of recovery plans is to describe reasonable actions and criteria that are considered necessary to recover a listed species. The Recovery Plan recommends increased conservation and restoration of spotted owl sites and high-value spotted owl habitat.

The 2011 Revised Recovery Plan (RP) represents the "best available science." The Forest has taken special steps to ensure that the Gordon Hill Project is consistent with the recovery actions within the 2011 Revised RP.

The 2011 NSO RP recognizes the importance of maintaining, and restoring, habitat for

the recovery and long-term survival of the spotted owl. "Long-term spotted owl recovery could benefit from forest management where the basic goals are to restore or maintain ecological processes and resilience. Therefore, we recommend application of disturbance-based principles to such decisions (Franklin et al. 2002, 2006, 2007, Drever et al. 2006, Noon and Blakesley 2006, Carey 2007, Long 2009, Swanson et al. 2010)." The 2011 RP relies on Federal lands to provide the major contribution for recovery (USDI Fish and Wildlife Service 2011).

On December 4, 2012 the Final 2012 Northern Spotted Owl Critical Habitat rule was published. Critical habitat consists of those areas which have physical or biological features essential to the conservation of the species. The 2012 Northern Spotted Owl Revised Critical Habitat Rule states "we encourage land managers to consider implementation of forest management practices recommended in the Revised Recovery Plan to restore natural ecological processes where they have been disrupted or suppressed (e.g., natural fire regimes), and application of ecological forestry management practices ….".

Currently, there is 14,528 acres (34%) of suitable nesting habitat for late-successional habitat species such as the northern spotted owl (NSO) in the Gordon Hill project area. The plantations and natural pole-sized stands proposed for treatment are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. These young stands have the potential to achieve rapid diameter and height growth with commercial thinning. As these stands develop, the acres suitable for NSO and other late-successional associated species should increase. By treating currently unsuitable habitat adjacent to existing late-successional habitat, larger patches would develop.

Currently, the project area is categorized as having a high risk of catastrophic or stands replacing fire (Smith River WA and LSRA 1995). Existing late-successional habitat is at risk. Early seral vegetation is highly susceptible to loss in a fire (dense, interlocking canopy). Treatments that reduce the time stands are in early seral stages may reduce the risk of stand replacing fire. In addition, construction of the fuelbreaks would reduce the fuels along road systems bisecting the area and serve as a control point for suppression activities. Removal of the ladder fuels would reduce the potential of intense heat and crown fires continuing unabated into existing habitat. The creation of these shaded fuelbreaks would assist suppression efforts in several ways: it would provide safe access for fire suppression crews; it would reduce the chance of a human-caused roadside fire from spreading into existing habitat; and it would create a break in the continuity of fuels to slow down the progress of any fire that might start within the project area. Shaded fuelbreaks in strategic areas would provide greater protection to existing late-successional habitat. This project would reduce fuel loads that could result in high-intensity wildfires that could negatively impact suitable wildlife habitat.

All Riparian Reserves (RR) within proposed units have a no-treatment buffer at a minimum width of 80 feet established, with equipment exclusion requirements in the remaining RR (approximately 160' total RR width. Little to no true riparian habitat exists within the dense young stands proposed for treatment within the project area. In the long term, project implementation has the potential to improve riparian habitat conditions through the release of conifer and hardwoods/shrubs from thinning, generating a secondary canopy. The project would maintain high levels of coniferous canopy closure

within the project area adjacent to RRs. Implementation of the project would maintain and improve riparian habitat conditions.

Implementation of this project would protect and improve habitat conditions 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).

Threatened, Endangered and Forest Service Sensitive Species

Direct, indirect and cumulative effects to threatened, endangered, and Sensitive species (TES) are disclosed in the Biological Assessment/Biological Evaluation (Devlin-Craig 2014; located in the project file) for the Gordon Hill Vegetation and Fuels Management Project, and the results are summarized here. The BA/BE contains 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, aerial photographs, and field reviews conducted by the wildlife biologist. The species considered are known to or are suspected to occur in the project area (*Six Rivers National Forest Forest-wide Reference Document*, September 2013).

No Action Alternative

Direct and Indirect Effects

Under the No Action alternative, no commercial or pre-commercial thinning, shaded fuelbreak construction, or activity fuel treatments would occur. The No Action alternative would not change the current conditions. No suitable or Critical habitat for any TES species would be modified through commercial thinning or shaded fuelbreak construction. There would be no disturbance to TES species during the breeding season. However, the No Action alternative would not accelerate the development of late-successional conditions in younger stands throughout the project area, or the LSR. The Six Rivers' Land Management Plan used computer growth models to determine the effects of thinning prescriptions designed to mimic natural disturbance on stand age. The results of this modeling showed that succession could be accelerated by as much as 30 years per seral stage, depending on site specific conditions. Treatments of shrub, pole, and early mature stands could accelerate the development of late-mature and old growth stands by as much as 90 years. The No Action alternative could delay the development of late-successional habitat by as much as 90 years, which in turn would delay the reduction of fragmentation and delay achieving larger habitat patch size.

The No Action alternative would also not help alleviate the fuels problem in the area. Plantations and young natural stands that are left untreated would be a greater fire hazard in the long run because they are greatly overstocked (many trees per acre with dense, interlocking canopies). Treatments within these stands would reduce existing fuels. Thinning in plantations improves growing conditions for the remaining trees by reducing competition for light and nutrients. Without treatment, tree-to-tree competition may cause far greater mortality in the stand. Periods of competition-induced die-offs could generate large amounts of fuel in shorter time frames.

There are heavy fuels along the roads in the project area. Many of these areas contain a

sufficiently dense fuel ladder (moving from the ground up to live limbs of a trees) to allow fire to easily make its way from the ground to the canopy. Under the No Action alternative no treatment would occur along these roads and the risk of a fire doing catastrophic damage to the existing late-successional habitat would remain high.

Proposed Action Alternative

Northern Spotted Owl (*Strix occidentalis caurina*)

Status: Federally Threatened

Recovery Plan

The 2011 Recovery Plan recognizes the importance of maintaining, and restoring, habitat for the recovery and long-term survival of the spotted owl. The 2011 Recovery Plan relies on Federal lands to provide the major contribution for recovery (USDI Fish and Wildlife Service 2011).

The USFWS found that due to "The continued decline of the spotted owl populations and low occupancy rates in large habitat reserves, and the growing negative impact from barred owl invasions of spotted owl habitats (Forsman et al. 2011, Dugger et al. in press), which is greater than anticipated in the NWFP. We recommend **increased conservation and restoration of spotted owl sites** and high-value spotted owl habitat to help ameliorate this impact" (2011 RP) (emphasis added).

The 2011 RP states:

> "This Revised Recovery Plan was developed using the best scientific information available and a "step-down" approach of objectives, criteria and actions. … Recovery actions are the Service's recommendations to guide the activities needed to accomplish the recovery criteria. Recovery actions are recommended throughout the U.S. range of the spotted owl and **are designed to address the specific threats identified in this Revised Recovery Plan**" (emphasis added).

The Gordon Hill Project was designed to meet the objectives of the 2011 RP as follows:

Recovery Action 32 states:

> "Maintaining or restoring forests with high-quality habitat will provide additional support for reducing key threats faced by spotted owls" and "Protecting these forests should provide spotted owls high-quality refugia habitat from the negative competitive interactions with barred owls that are likely occurring where the two species' home ranges overlap. Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures".

Forsman et al 2011 recommended that all potential NSO habitats should be considered, not just old-growth. The Six Rivers definition of suitable nesting/roosting (N/R) NSO habitat includes mid-mature (starting at 21" DBH), late-mature and old-growth seral stages. All potential habitat was considered during project evaluation, and all high quality habitat (no matter what seral stage) was dropped from treatment. Low quality habitats

were evaluated for habitat improvements measures. If the habitat could benefit from a silvicultural treatment, then it was considered for the project.

The definition of NSO N/R habitat used for this project was based on the definition found in the Six Rivers Land and Resource Management Plan (LRMP) and field verified by wildlife biologists with extensive experience with the species. The LRMP definition was based on the extensive amount of published literature and represents the best available science for the Six Rivers habitat types.

All high-quality stands were dropped from treatment on this project. Approximately 12 acres of moderate quality N/R habitat will receive fuels reduction (removing brush and small diameter trees less than 8" DBH) within 50 ft. of a high-use road. Treatment of these areas will help protect existing high-quality NRF habitat from human-caused fires. This project meets the intent of Recovery Action 32 and the need to reduce inter-specific competition between spotted and barred owls.

Recovery Action 10 requires that agencies:

> "Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population".
>
> "When planning management activities, Federal and non-federal land managers should work with the Service to prioritize known and historic spotted owl sites for conservation and/or maintenance of existing levels of habitat."

Because the Six Rivers strives towards recovery of the spotted owl, *all* ACs receive the same level of protection and are not prioritized with some ACs getting less protection as allowed by the Recovery Plan. This exceeds the requirement of the RA 10 of the 2011 RP. In addition, the USFWS requires a 70-acre nest grove protection zone. In this project we exceeded 70 acres around each known AC, which was incorporated into the project design (see the Biological Assessment for the project for specific information rlating to nest groves). No activities will occur within the nest groves.

Recovery Action 6 states:

> "In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands, and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery."

The Gordon Hill Project is designed to restore and accelerate development of important habitat characteristic for the spotted owl. This includes plantations and overstocked stands that, if treated, will increase the available habitats for the spotted owl and help reduce inter-specific competition between the barred owl and the spotted owl. Treatment of these stands will have an immediate benefit to the spotted owl.

This project has protected all high quality habitat (not just old-growth, but also late mature and some mid mature stands, RA32), all spotted owl territories (not just high priority sites, RA10) and is designed to restore and accelerate important habitat characteristic for the spotted owl (RA6) in young overstocked stands. Such long-term protection of owl habitat is consistent with the recommendations in the 2011 Recovery Plan.

The 2011 Plan states "Dugger *et al.* (in press) found an inverse relationship between the amount of old forest within the core area and spotted owl extinction rates from territories" when barred owls were present. The RP also states due to the "growing negative impact from barred owl invasions of spotted owl habitats *(*Forsman *et al.* 2011, Dugger *et al.* in press) …,We recommend increased conservation **and restoration of spotted owl sites and high-value spotted owl habitat to help ameliorate this impact"** (emphasis added)**.** Barred owls have been documented using a wider range of forest types (younger seral stages with more fragmentation) than spotted owls (Hamer 1988, Herter and Hicks 2000, Kelly et al. 2003, Hamer et al. 2007). Consequently, the loss of late-successional old-growth forest and increased fragmentation of these forests will decrease the amount of suitable habitat for spotted owls. In other words, without treatment of non- or poor-quality habitats in deficit core areas we may lose these sites to barred owls. The Recovery Strategy of 2011 Recovery Plan supports "active forest management" and states that "In addition to describing specific actions to address the barred owl threat, this Revised Recovery Plan continues to recognize the importance of **maintaining and restoring high value habitat for the recovery and long-term survival of the spotted** owl.**"** (Emphasis added). The Gordon Hill treatments within owl territories, including core areas, are designed to accelerate the development of old forest characteristics, which will improve habitat conditions within spotted owl territories. The project meets the objectives of the 2011 Recovery Plan.

Barred owl

Barred owls are recognized as a significant threat to the recovery of the NSO (USFWS 2011). The RP addresses barred owls under RA 32 and RA 10 which are found under the "Barred Owl Recovery Actions". The barred owl recovery actions were developed under the assumption that barred owls now occur at some level in all areas used now or in the past by spotted owls. This is true for the Gordon Hill area as well. Surveys for this project found three barred owl sites. The 2011 RP addresses the threat to the NSO from the barred owl through the preservation of existing high quality habitat (RA 32) and preservation of high priority NSO territories (RA 10). The RP also addresses the need to restore additional habitat for the owl in order to ameliorate the impact of the barred owl. While additional barred owls may or may not be present in the action area, implementation of RA 10 and RA 32 fully meets the best available barred owl mitigation measures by protecting, maintaining and restoring spotted owl habitat.

The 2011 RP was informed by Forsman et al 2011 and Dugger et al (in press at the time but subsequently published in 2011). The RP states due to "The continued decline of the spotted owl populations and low occupancy rates in large habitat reserves, and the growing negative impact from barred owl invasions of spotted owl habitats (Forsman et al. 2011, Dugger et al. in press), which is greater than anticipated in the NWFP. We recommend increased conservation **and restoration of spotted owl sites** and high-value spotted owl habitat to help ameliorate this impact".

Recovery Action 32 specifically states: "Maintaining or restoring forests with high-quality habitat will provide additional support for reducing key threats faced by spotted owls" and "Protecting these forests should provide spotted owls high-quality refugia habitat from the negative competitive interactions with barred owls that are likely occurring where the two species" home ranges overlap. Maintaining or restoring these

forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures". All high-quality stands were dropped from treatment on the Gordon Hill Project due to this recovery action and the need to reduce inter-specific completion of the owls and restoration activities are proposed for non-habitat or low-quality habitat stands.

Recovery Action 10 requires that agencies "Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population". Maintaining all historic ACs is a standard Six Rivers National Forest protection measure. The Six Rivers database includes NSO ACs that predates the 1990 listing of the NSO. All historic ACs (currently occupied or not) that meet the criteria of an AC (described in the USFWS survey protocol) are considered during project evaluation. The Gordon Hill Project had 7 historic ACs mapped, with one additional AC located during project-level surveys. All 8 ACs were found to be active during the 4 years of surveys to protocol (2010 to 2013). All high quality habitat, regardless if it was located within an active AC, was dropped from consideration during project design. In addition, the USFWS requires a nest grove protection zone of a minimum of 70-acres around each known AC, which was exceeded for this project and incorporated into the project design. No activities will occur with the nest groves. The Gordon Hill Project meets Recovery Action 10.

The Gordon Hill Project has protected all high quality habitats (not just old-growth), all spotted owl territories (not just high priority sites) and is designed to restore, maintain, and accelerate important habitat characteristic for the spotted owl. "Maintaining or restoring these forests should allow time to determine both the competitive effects of barred owls on spotted owls and the effectiveness of barred owl removal measures" (II-67 of the 2011 Plan). Protecting these forests should provide spotted owls high-quality refugia habitat from the negative interactions with barred owls that are likely occurring where the two species' home ranges overlap. The Gordon Hill Project will not exacerbate competitive interactions between the two species. Without the implementing the additional protection measures and recovery actions of the 2011 RP, the barred owl may be successful in out-competing the spotted owl. It is imperative to the spotted owl's recovery to take such actions. The Gordon Hill Project is meeting the objectives of the 2011 RP.

Fire

Another threat to the NSO addressed by the 2011 Recovery Plan is wildfire. The 2011 RP identifies stand-replacing wildfire as one of the three top threats to the recovery of species stating "currently the primary source of habitat loss is catastrophic wildfire …." The RP further notes that wildfire size and frequency have been increasing in the western US and that acres burned are expected to continue to increase due to climate changes and past land management practices. This overall increase in acres burned translates to a corresponding increase in the acres of spotted owl habitat lost to fire. While the risk of habitat loss to wildfire varies by location, the 2011 RP emphasized that the Klamath region is one of the main areas at risk:

> "fire-prone provinces (including) California Klamath scored high on threats from ongoing habitat loss as a result of wildfire and the effects of fire exclusion on vegetation change."

> "In view of the increasing risk posed to northern spotted owl habitat by wildland fire in the dry forests of the California Klamath Province, the Recovery Plan calls for management actions that result in forests that are more fire resilient and fire-resistant."

The Six Rivers National Forest area is within the Moist Forest zone of the spotted owl's range as delineated in the 2011 Recovery Plan. However, the area's dry, hot summers and extreme departure from its historic fire return interval mean that owl habitat within many areas of the Forest is at risk of being lost to, or significantly degraded by, severe fire. The 1999 Megram Fire (120,000 acres), 2002 Biscuit Fire (500,000 acres), the 2008 Lightening Complex (45,000) and many other, smaller fires all removed suitable NSO habitat on the Six Rivers, and demonstrates that the fire risk on the Forest is genuine. Active management to reduce the fire hazard and increase resilience, as well as to accelerate the development of higher quality NSO habitat, should contribute to the spotted owl's persistence and recovery. Such long-term protection of owl habitat is consistent with the recommendations in Forsman 2011 as well as the 2011 Recovery Plan and 2012 Revised NSO Critical Habitat Rule.

Impacts to Pacific Northwest forests from wildfire appear to be increasing along with fire occurrence, size, and intensity. Although some researchers disagree on the magnitude of these changes and what to do about them (e.g., Hanson et al. 2009, Baker 2012), most researchers believe, as does the USFWS (USDI 2012b), that these changes are happening, and that active management should be considered (e.g., Hessburg et al. 2007, Healy et al, 2008, Heyerdahl et al. 2008, Kennedy and Wimberly 2009, Latta et al. 2010, Littell et al. 2009, 2010, Spies et al. 2010, Perry et al. 2011, Syphard et al. 2011, Waring et al. 2011, Jenkins et al. 2012, Mallon et al. 2012, Miller et al, 2009, 2012). Thus, this project takes the active management intervention approach rather than a passive approach to restoring NSO habitat. This approach is what was envisioned by the Northwest Forest Plan, the 2011 NSO RP, and the 2012 Revised NSO Critical Habitat Rule.

Northern Spotted Owl Habitat

Nesting/Roosting

The average home range of the northern spotted owl is 3,398 acres in this portion of its range, which equates to a circle with a 1.3 mile radius from the center of the territory or "activity center" (AC). Research indicates that the most activity within a territory occurs within 0.5 miles of the nest tree. Northern spotted owl territories with at least 400 acres of suitable nesting/roosting/foraging habitat within 0.5 miles and 1,336 acres within 1.3 miles of the nest tree are generally thought to have a higher chance of occupation.

Suitable NSO N/R habitat, as defined by the Forest Service, is comprised of mature timbered stands having multi-layered conditions, an average canopy closure of 60 percent or greater (both conifers and hardwoods) and obvious decadence. The overstory should be comprised of conifer trees 21 inches or greater diameter at breast height (DBH). Conifer canopy closure should be 40 percent or greater. This habitat is used primarily for nesting/roosting. This definition shows its accuracy when compared to the actual nest locations on the Six Rivers National Forest where it is the predominant type used by nesting spotted owls.

Nests are usually in snag cavities or broken tops of large trees in mature/old-growth

forest. Daytime roost sites in northern California are in dense, multi-layered canopy forests, and average 550 feet from water.

Foraging

NSO forage in forested habitats with hunting perches and a stand structure that allows for flight in the understory and access to prey. The Gordon Hill planning area includes a variety of habitats that provide the NSO with foraging opportunities.

In 2009, the Yreka Fish and Wildlife Office in northern California prepared an unpublished white paper titled "Regulatory and Scientific Basis for U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region". In the paper the USFWS stated that "The USFWS has conducted a thorough review and synthesis of published literature, unpublished data sets, and direct communication with NSO researchers in support of a rigorous process for evaluating the effects of habitat management on NSO." The paper included information on the NSO across California with research specific to the Six Rivers National Forest.

In the white paper the USFWS acknowledged that

> "Habitats used by NSO are highly variable, particularly in the diverse conifer-hardwood forests of the Klamath Province"
>
> "Spotted owls also forage within intermediate (younger and/or more open) forest classes. One study (Zabel et al. 2003) found a positive association between NSO in the Klamath Province and moderate amounts of intermediate forest at the core area scale. This habitat class was based on conditions known to be used by foraging NSO."
>
> "Foraging habitat encompasses nesting and roosting habitat but includes a broader range of structure and might not support successful nesting by NSO (Gutiérrez 1996, USFWS 2008). Foraging NSO generally use older, denser, and more complex forest than expected based on its availability, but they also use younger forest (Solis and Gutiérrez 1990, Carey et al. 1992, Zabel et al. 1993, Carey and Peeler 1995, Anthony and Wagner 1999, Irwin et al. 2007b)."
>
> "foraging habitat encompasses a broad range of structure, and low-quality foraging habitat includes younger and more open habitats that may be important for prey production"

Based on the extensive research review conducted, the USFWS went on to define "infrequently-used", low-quality foraging habitat as having a minimum of 40% canopy cover and 11 inch DBH conifer trees.

In the 2012 Critical Habitat Rule, the USFWS acknowledged that "Compared to other zones, (in the Klamath and Northern California Interior Coast Ranges) additional foraging habitat for this zone showed greater divergence from nesting habitat, with much lower canopy cover and tree size."

In the 2011 Recovery plan for the Northern Spotted Owl, the USFWS stated "Because the characteristics of the stands or patches targeted by this recovery action vary widely across the range of the species, the Service believes implementation and/or mapping of

this recovery action is best left to interagency teams with localized expertise."

As stated in the white paper (USFWS 2009) "Determination of the amount of suitable habitat that must be retained in order to avoid incidental take of NSO is strongly influenced by the range of forest conditions that are classified as suitable habitat." Narrowly defining what constitutes suitable habitat can severely underestimate impacts to the NSO. The Six Rivers National Forest/Arcata Fish and Wildlife Service Level 1 Team conservatively and broadly defines low-quality habitat as having a minimum of 40% canopy cover and 11 inch DBH conifer trees.

Under the Proposed Action, the Gordon Hill Project will treat 12acres of moderate quality (MQ) N/R and 555 acres of foraging (F) habitat. The 12 acres of N/R, 6 acres of MQF, and 191 acres of low quality (LQ) F will be modified through the creation of a shaded fuelbreak and 358 acres of LQF will be modified through commercial thinning.

Prey Species

In this portion of the northern spotted owls range (below about 4100 feet in southern Oregon and northern California), dusky-footed wood rats (*Neotoma fuscipes*), are the most important prey species of spotted owls, both in frequency and biomass (Forsman 1975, Barrows 1980, Solis 1983, Forsman et al. 1984, Ward 1990, Carey et al. 1992, Zabel et al. 1995, White 1996, Ward et al. 1998 Forsman et al. 2004 and Hansen and Mazurek 2010).

In a study conducted on the Six Rivers National Forest, Sakai and Noon (1993) found the highest abundance of woodrats occurred in 15-30 year-old plantations resulting from past clearcut timber harvest. The study used radio telemetry to track the movement of woodrats and found that although the woodrats inhabited younger stands, woodrats would often cross distinct ecotonal boundaries between forest types. Woodrats tracked during evening telemetry sessions made intermittent, short distance movements into adjacent old-growth forests occupied by spotted owls. A substantial number of radio tagged woodrats were killed by predators, with carcasses most often found in adjacent old forest. This is presumably due to the fact that these younger, dense plantations are difficult if not impossible for the owl to forage in and must wait until the prey leave these refugia to be preyed upon.

Ward et al (1998) found that owls foraged along late-seral forest edges where dusky-footed woodrats were more abundant. Woodrats living in or dispersing from adjacent shrub lands may be more available for owls hunting along the ecotonal edges between habitat types. Edge or transitional habitats appear to be more important to foraging spotted owls when woodrats dominate the diet (Zabel et al. 1995, Ward et al. 1998). Edges may provide cover to conceal owls from predators while making them inconspicuous to wood rats.

These results suggest that the infrequent use of younger stands by foraging spotted owls is not due to low abundance of prey. Simply increasing prey densities within a stand may not result in an increase in prey available to spotted owls if their foraging efficiency is low in these stands (Noon, Rosenberg, Zabel 1994). High tree densities and homogeneous canopies in second-growth forests may reduce flight maneuverability and the ability of owls to capture prey (Rosenberg and Anthony 1992). However, silvicultural procedures that maintain or enhance woodrat populations adjacent to spotted owl habitat

may benefit spotted owls (Sakai and Noon 1993, Irwin et al. 2007).

Stands occupied by woodrats gradually decline in suitability. Data from Sakai and Noon (1993) suggest that this occurs when the dominant trees (usually Douglas-fir) begin to over top and eventually suppress the low-to-mid-canopy level vegetation (< 3-6 m). In the inland forests of northwestern California, the decline in habitat quality occurs in regenerated stands at about 40-50 years after harvest. To enhance dusky-footed woodrat populations, Sakai and Noon proposed retaining brush patches during precommercial thinning and creating brush patches in younger stands. The existence of shrub fields or younger stands adjacent to older forest may increase the availability of woodrats to spotted owls that exploit prey from a variety of habitats but spend the majority of their time hunting in late seral stage forests (Sakai and Noon 1993).

The northern flying squirrel (*Glaucomys sabrinus*) is a smaller component of the biomass collected by the spotted owl in this portion of the province. In northwestern California, flying squirrels constitute only 9.3% of the biomass of NSO diet, while dusky-footed woodrats constitute 70.9% of the biomass of NSO diet (Ward et al. 1998).

Forsman et al 1984 described potential negative impacts to flying squirrels through the timber harvest; however the conditions described by Forsman occurred in heavily thinned mature and old growth stands. No high quality habitat nesting/roosting is being treated under the Gordon Hill Project. Thinning might also affect flying squirrels through reduction or development of other important resources, such as shrubs, hardwoods, arboreal lichens, or deformed trees and snags (Williams et al. 1992, Carey 1995). The Gordon Hill Project will protect these important habitat components. Hansen and Mazurek (2010) found “mixed” results in relation to the flying squirrel, with some studies showing no effect at all from the thinnings compared to unharvested stands.

Northern Spotted Owl Status within the Gordon Hill Planning Area

There are 8 identified northern spotted owl activity centers located within the Gordon Hill planning area. Four of the ACs home ranges (1.3 miles) extend beyond the planning area. The planning area is 42,724 acres in size. There are 14,528 acres of NSO N/R and 14,190 acres of F habitat in the planning area. Including the 4 NSO territories that extend beyond the planning area, the Action Area is 46,164 acres. There are 15,664 acres of NSO N/R and 14,958 of F in the Action Area.

There are also 3 additional ACs outside of the planning area whose home ranges overlap the planning area (AC #13, 26, and 29); however, no treatments will occur in the territories. These ACs were not addressed any further.

Nesting/roosting habitat was originally determined through use of current geospatial data. Field verification of this data was conducted by wildlife biologists. All high quality habitat was dropped from treatment.

Northern spotted owl protocol surveys were conducted in all suitable habitats for the Gordon Hill Project in 2010 through 2014. In addition, northern spotted owl surveys were conducted within the planning area in the early and mid-1990s. There is one 100-acre Late Successional Reserves (LSR) located in associated with the Coon Creek AC; however, the LSR does not coincide with the actual nest grove (which is based on the owl’s location) for the activity center. Approximately 14 acres of this LSR-100 will have

fuels reduction treatments (shaded fuelbreak) that occur in low quality foraging habitat.

The habitat conditions are considered low quality for NSO throughout much of the project area. Past management has removed large tracts of suitable N/R habitat and fragmented remaining patches. Extensive areas of 40+ year old plantations and young natural stands occur throughout the project area.

There are 665 acres proposed for commercial harvest and 801 acres of TSI that would be treated using conventional harvest systems. All commercial and pre-commercial thinning would occur in plantations (40+ years old) and young natural stands. None of the commercial or precommercial treatments occur in suitable N/R habitat for the NSO. LRMP modeling showed that succession could be accelerated by as much as 30 years per seral stage, depending on site specific conditions. Treatments of shrub, pole, and early mature stands could accelerate the development of late-mature and old growth stands by as much as 90 years. Treatments would change the stand structure and allow large trees to develop, accelerating the development of functional late-successional habitat. Silvicultural prescriptions (such as variable density thinning where areas within the stand are left untreated) would ensure retention of existing stand structure, species composition, snags, and downed logs.

Northern Spotted Owl Critical Habitat

Critical habitat consists of those areas which have "physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection." 16 U.S.C. § 1532(5)(A). These physical or biological features are referred to as the "primary constituent elements" (PCE) associated with the terrestrial environment that support nesting, roosting, and other normal behaviors are essential to the conservation of the NSO. The PCEs of NSO CHU are coniferous forest types that support the NSO in nesting/roosting, foraging, and dispersal (D).

Approximately 17,899 acres of the Action Area occurs within the Unit 9, Klamath West Subunit 6 of the 2012 NSO Critical Habitat. Under the Proposed Action, there are 10 units to be commercially thinned (131 acres), 9 units to be precommercially thinned (200 acres), and 22 units (170 acres) of fuel break construction that will occur in NSO CHU. A total of 501 acres will be treated in CHU, 420 acres of NSO NRFD habitats and 81 acres non-habitat. Commercial thinning will occur in 69 acres of LQF and 62 acres of dispersal-only habitat. Fuelbreak construction will occur in 12 acres of MQN/R, 65 acres of LQF, and approximately 105 acres of dispersal-only habitat. TSI will occur in 107 acres of dispersal-only habitat. A total of 12 acres of MQN/R, 134 acres of LQF, and 274 acres dispersal-only habitat will be modified but maintained within NSO CHU.

The 2012 CHU Rule states:

> "we encourage land managers to consider implementation of forest management practices recommended in the Revised Recovery Plan to restore natural ecological processes where they have been disrupted or suppressed (e.g., natural fire regimes), and application of ecological forestry management practices (e.g., Gustafsson et al. 2012, entire; Franklin et al. 2007, entire; Kuuluvian and Grenfell et al. 2012 entire) within critical habitat to reduce the potential for adverse impacts associated with commercial timber harvest when such harvest is planned within or adjacent to critical habitat. In sum, the Service encourages land

> managers to consider the conservation of existing high-quality northern spotted owl habitat, the restoration of forest ecosystem health, and the ecological forestry management practices recommended in the Revised Recovery Plan that are compatible with both the goals of northern spotted owl recovery and Standards and Guidelines of the NWFP."

This project and the type of habitat proposed for treatment meets the recommendations of and are consistent with the 2012 CHU (and 2011 RP).

Nesting/roosting and Foraging Habitat

Initial potential treatment units were selected by a silviculturist from a vegetative database and then field verified as to stand density and structure. Field verification to determine potential habitat status was completed by a wildlife biologist. All stands classified as high quality habitat was excluded from treatment. Mid-mature stands with predominant trees were ground verified as to whether they contained stand structure characteristics that would be classified as high quality nesting roosting habitat. All high quality nesting/roosting habitat stands (those in mid-mature stands with mature forest characteristics, late mature, and old growth) were dropped from treatment

Alternative 2, (Proposed Action)

Direct and Indirect Effects of the Proposed Action

The following discussions group direct and indirect effects into two primary categories, nesting/roosting and foraging habitat. Within each broad habitat category effects will be grouped into direct habitat removal and habitat maintenance, as well as impacts to activity centers. Disclosing impacts by individual activity center can be misleading because the same acre treated may be reported more than once due to an overlap of activity centers.

The USFWS defines "habitat maintenance" as a reduction in stand density, but the current habitat function would be maintained immediately post project with the purpose of improving habitat quality over time. "Removal" occurs when the habitat no longer functions as nesting/roosting or foraging habitat (e.g. clear cutting). Habitat maintenance treatments are treatments designed to maintain and enhance habitat. A "downgrade" is taking a higher habitat quality down to a lower habitat type; such as removing too much canopy and making a nesting/roosting stand only suitable as foraging habitat.

No habitat removal or downgrading will occur under the Gordon Hill Project except for 0.97 acres of LQF in negligible amounts in any one area for landing and temporary road construction. Three landings, up to approximately 0.25 acres in size will be constructed in LQF for a total of 0.75 acres. Two temporary roads (0.08 and 0.07 miles) will be constructed in LQF for a total of 0.22 acres.

The USFWS has determined minimum habitat thresholds, or the minimum amount of nesting/roosting (N/R) and foraging (F) habitat, that must be maintained in a territory within a specific distance from the core area of use in order for an NSO pair to persist at the site. Habitat removal or downgrading that reduces habitat below this minimum threshold may be considered "take" under the Endangered Species Act (ESA). Habitat removal that did not reduce the amount of habitat below this threshold was not considered take, although the impacts could still be considered adverse. For example,

depending on the location (spatial relationship of proposed treatment areas to existing habitat), amount treated, and intensity of the treatment, actions that modify habitat but maintain habitat functionality without any habitat removal could still have adverse impacts on the owl if a territory was already below the "take" threshold. The Level 1 Team developed the Project Scope and Intensity Analysis (PSIA), a series of questions that guide the biologist through an analysis of potential effects for each owl AC within the project area. The PSIA was conducted that evaluated all 8 NSO ACs within the analysis area which addressed each AC for the current amount of NRF in relation to the threshold, the amount and location of proposed treatments, and the percentage of NRF affected. The results of the PSIA were used to further modify the treatments in order to ensure that no adverse effects would occur and that restoration activities would benefit the NSO.

The stands selected for treatment minimally met the definition of suitable NRF habitat, but have a lower likelihood contributing to survivorship or reproduction. The stands had one or more features of suitable habitat, but lacked other important characteristics that reduce their likelihood of occupancy or use. For example, a stand may have adequate average tree size and canopy cover, but may be even-aged and lack large (potential nest) trees or multi-layered canopy conditions. The Gordon Hill Project was designed to maintain current characteristics of nesting/roosting and foraging habitat but, more importantly, to create the currently lacking, critically important habitat characteristics, including habitat components the woodrats depend upon. The stands selected for treatment have limited or are devoid of understory vegetation, and provide little habitat for this key prey species.

The Gordon Hill project proposes approximately 665 acres of commercial thinning and 801 acres of timber stand improvement. In addition, a fuelbreak would be created on 1,168 acres, 95 acres of Jeffrey Pine Grassland restoration and 20 acres of sugar pine restoration.

The Jeffrey-Pine /Sugar Pine treatments will restore Jeffrey pine grassland areas that are being encroached upon by dense brush and Douglas fir saplings as well as protecting large, predominant sugar pine that are being encroached upon by dense thickets of chinquapin and small diameter Douglas fir. None of these treatments occur in suitable NSO NRF habitat.

The Gordon Hill Project will treat 12acres of MQN/R and 549 acres of LQF and 6 acres MQF habitat. The 12 acres of N/R, 6 acres of MQF, and 191 acres of F will be modified through the creation of a shaded fuelbreak and 368 acres of LQF will be modified through commercial thinning. The remaining acres are considered non-habitat for spotted owls and are primarily fuels treatments in pine stands.

There are 15,664 acres of N/R and 14,958 of F in the action area. It is expected that current habitat function will be maintained in all treatment areas immediately post-project (as was seen in the post-treatment Level 1 Team review of other Six Rivers habitat restoration projects); however, approximately 98% of the NRF in the project area will not have any treatment. Therefore, "adequate alternative habitat" as suggested by Forsman (2011) is being left untreated. The project will develop functional prey habitat that is currently lacking in the stands and should lead to higher survival and reproduction rates for the owls.

No nesting/roosting habitat and approximately 368 acres of low quality foraging habitat will be commercially thinned. The Gordon Hill Project is a low-intensity thinning from below that will not remove any predominant trees and canopy closure will be maintained at 40% or greater in foraging habitat. Approximately 12 acres of MQNR, 6 acres MQF, and 191 acres of LQF will be modified through fuelbreak construction. Only brush and small diameter trees (8" DBH or less) will be removed in the fuelbreaks. No overstory trees will be removed and canopy will be maintained at existing levels. No treatments will occur in spotted owl nest groves or high quality NR habitat. Adequate alternative habitat (98% NRF untreated) exists in the action area.

This project has protected all high quality habitat (not just old-growth, but also late mature and some mid mature stands, RA32), all spotted owl territories (not just high priority sites, RA10) and is designed to restore and accelerate important habitat characteristic for the spotted owl (RA6) and protect existing suitable habitat from stand replacing fire. Such long-term restoration and protection of owl habitat is consistent with the recommendations in the 2011 Recovery Plan.

Nesting/Roosting Habitat

Nesting/roosting Habitat Removal

No N/R habitat will be removed for this project.

Commercial Thinning

No N/R habitat will be commercially thinned.

Nesting/roosting Habitat Maintenance

Portions of 11 sections of the fuelbreak (F01A, F03A, F08B, F09B, and F-40A through F-46A) occur in high quality nesting/roosting habitat. The portions of F01A, F03A, F08B, and F09B that occur in HQNR all occur in Riparian Reserves and will not have any treatment. In some cases, the fuelbreak will be shifted to the other side of the road (out of the RR and out of HQNR) to maintain continuity. The units F40A through F46A occur along County Road 405 and Hurdygurdy Creek. The highest quality habitat occurs on the south side of Rd 405 along the creek, which will not have any treatment. The fuelbreak units on the north side of 405 contain from pole/early mature to small patches of late mature seral stages (foraging habitat to N/R) in varying locations and amounts. To take the most conservative approach, the entire area will be considered as moderate quality N/R.

The total acreage for fuelbreak units F40A through F46A is 73 acres; however half of the fuelbreak occurs in the Hurdygurdy Creek RR and will not be treated. Of the remaining 36.5 acres, only the first 50 feet within N/R habitat will be treated. This results in a fuelbreak construction in approximately 12 acres of moderate quality NR habitat. Since sections of this approximately 2 mile long area of fuelbreak occur in younger stands, 12 acres overestimates the amount of NR habitat being treated. In the younger stands in this area, the fuelbreak treatment described above will occur within the first 50 feet (roadside). In the remaining 50 to 100 ft. (depending if the area is adjacent to a ridge top), 40-50% of existing brush will be maintained in a mosaic pattern for prey species cover. Overstocked trees <8" DBH will still be reduced and pruning of residual trees will still be allowed in these areas.

Fuels reduction treatments may modify 12 acres of MQNR habitat through the removal of brush and small diameter trees (8" DBH or less) within 50 ft. of the road; however, all existing important habitat characteristics for nesting would be maintained and the stands would still function as N/R immediately post-project. Of the 15,664 acres of nesting/roosting habitat within the action area, approximately 12 acres of moderate quality nesting/roosting habitat would be treated. The amount of nesting/roosting habitat within the planning area proposed for treatment would be approximately 0.07% percent (99.93% N/R in the action area will not receive any treatment).

Strategically located fuelbreaks would reduce the risk of human-caused fire ignitions along high-use Forest and County roads and provide greater protection to existing late-successional habitat in the Gordon Hill Project area. Fuel reduction treatments are designed to protect existing habitat characteristics while reducing ground and ladder fuels and creating a defensible space to be used in defense of wildfires. Treatments are limited to pruning lower branches of larger trees and removal of brush and small diameter trees 8 "DBH or less. No overstory trees would be removed, no overstory canopy would be reduced, no understory trees over 8 inches would be removed for a fuels treatment, and large snags and downed wood would be maintained at the 80-100 percent level. Cut material in N/R habitat will be hand piled and burned. The habitat would remain suitable immediately post project.

No activities will occur in high quality N/R habitat or in 70+-acres nest grove of any AC, and no activities will occur within 0.25 mile of any activity center during the breeding season.

Foraging Habitat

Foraging habitat generally has attributes similar to that of nesting/roosting habitat, however does not contain the structural characteristics necessary to support successfully nesting pairs. The foraging habitat selected for treatment in the Gordon Hill Project is lacking diversity of species and sizes as well as structural components such as multi-layered conditions, snags, downed wood and decadent structures such as large limbs, broken tops, and cavities.

There are 14,958 acres of foraging habitat in the action area. The Gordon Hill Project will treat 549 acres of LQF and 6 acres MQF habitat. Of the 555 acres of foraging being treated, 191 acres of LQF and 6 acres of MQF will be modified through the creation of a shaded fuelbreak and 358 acres of LQF will be modified through commercial thinning. Approximately 3.7% of the foraging habitat in the action area will receive treatment. Approximately 232 acres of the low quality F habitat being treated occurs outside of a known AC.

NSO will also forage in N/R habitat. There are 15,664 acres of N/R and 14,958 of F in the action area. It is expected that current habitat function will be maintained in all treatment areas immediately post-project (as was seen in the post-treatment Level 1 Team review of the Beaverslide Project on the Mad River District treated in 2012 which implemented similar prescriptions); however, approximately 98.6% of the NRF in the action area will not have any treatment. Therefore, "adequate alternative habitat" as suggested by Forsman (2011) is being left untreated. The project will develop functional prey habitat that is currently lacking in the stands and should lead to higher survival and

reproduction rates for the owls.

Foraging Habitat Removal

The only treatments that would remove habitat would be the construction of new roads or landings. Three new landings will be constructed in LQF habitat. Each landing will be up to 0.25 acres in size. A total of approximately 0.75 acres of foraging habitat would be removed through new landing construction. In addition, two new temporary roads will be constructed (0.08 mi and 0.07 mi) for a total of 0.15 mi (0.22 ac) of temporary road construction in LQF. Temporary road width would be approximately 12 feet wide, the minimum allowed. Canopy loss would be minimal and may not be more than the thinning surrounding the road. Removal of habitat for landings and roads is limited to small areas and is considered insignificant because after treatment they will be decommissioned and will resemble small forest openings. Small openings can be beneficial in stands lacking structural diversity to "maximize individual tree development, encourage some understory vegetation development, and encourage the initiation of structural diversity" (Interagency Regional Ecosystem Office memorandum 1996). Often the canopy above the roads still falls within the 40% retention thresholds but is being considered removed to evaluate the full potential of affects to any given activity center.

The majority of landings that will be used for this project are existing openings that will only need minor expansion and brushing for safe operations. A small number of trees may be removed along cable lines in association with skyline landings within the unit boundaries for safety reasons

Two of the three landings and the two temporary roads occur within an AC. All 3 actions will occur within the outer 1.3 mile radius of the 2 affected ACs. Neither of the 2 ACs are deficit in foraging habitat in the 1.3 mile home range. The maximum amount of foraging habitat that will be removed in any one Activity Center is 0.6 acre, 0.25 acre in any one area. Total removal by new road and landing construction would be 0.97 acres of the 14,528 acres of foraging-only habitat in the action area. The loss of habitat in any one area would be negligible and would resemble natural assemblages and small forest openings.

The removal of these small patches (0.25 or less in any one area) of low quality foraging habitat (totaling 0.97 acres) will allow the treatment of 71 acres of other low quality stands of foraging habitat. In the long term this will improve the stands that are currently not providing adequate habitat conditions due to high tree density and lack of structural diversity. In the short term these small openings may be utilized by the owls for foraging (North et al 1999, Carey 1995).

Foraging Habitat Maintenance

Commercial Thinning

Approximately 358 acres of low quality foraging habitat would be commercially thinned. The treatments would occur in even-aged young stands that are in early seral stages of development.

Treatments would consist of variable density thinning. The general prescription would be commercial thinning from below down to between 40 and 60% or greater canopy cover,

although this would be highly variable. Variable basal area retention would be used to create gaps to promote horizontal diversity through the development of understory trees, while in other areas clumps of trees would be maintained to promote the development of snags. Individual trees with high potential for rapid growth would be widely spaced to accelerate diameter and height growth with the expectation of achieving vertical diversity. These trees are also expected to develop wide crowns and large limbs. No predominant trees would be removed. Existing snags (20" DBH or greater) and downed logs (20" diameter or greater and 10 feet long) would be maintained unless they pose a safety hazard or reduce the effectiveness of the shaded fuelbreaks.

The stands selected for treatment minimally met the definition of foraging habitat, but have a lower likelihood contributing to survivorship or reproduction. The stands have the tree diameter size and canopy cover of suitable habitat, but lack other important characteristics (such as multi-layered conditions that provide for prey species) that reduce their likelihood of use. Treatments were designed to accelerate the development of important habitat components currently lacking in the stands while retaining the existing structural elements, resulting in high restoration benefits. The project will improve habitat conditions and restore high quality habitat for the spotted owl. Canopy closure would be reduced in the short-term, but will be maintained at a minimum of 40%. Foraging habitat would remain suitable immediately post-project. In the long-term, the treatments should improve habitat conditions by accelerating the development of stand attributes important to the NSO (e.g., multi-storied stands and large-diameter trees with large crowns) and contribute to the recovery of the species.

In the plantations and dense, overstocked, early-mature stands (very low quality to not currently suitable foraging habitat) the benefit to the owl will be immediate. The treatments proposed will reduce the overstocked stems and ladder fuels that currently create a "safe haven" for woodrats since the owls cannot effectively forage in these dense stands. Treatments of these stands will create more acres of habitat on the landscape, helping reduce competitions between the spotted and barred owls for the same habitats.

The stands proposed for treatment are generally even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. These young stands have the potential to achieve rapid diameter and height growth with commercial thinning. As these stands develop, the acres suitable for spotted owls and other late-successional associated species should increase. By treating currently unsuitable habitat adjacent to existing late-successional habitat, larger patches would develop. Silvicultural prescriptions can be applied to these stands in order to accelerate their development toward late seral conditions. These treatments can increase the amount of late seral vegetation quicker than would occur naturally. Treatments would change the stand structure and allow large trees to develop, promote development of an understory canopy, accelerating the development of functional late-successional habitat. Silvicultural prescriptions (such as group retention where areas within the stand are left untreated) would ensure retention of existing stand structure, species composition, snags, and downed logs.

Thinning in currently low quality foraging habitat is the best prescription to maintain and recruit the habitat variables critical to NSO high quality foraging and nesting/roosting habitat. Treatments will have a positive impact on NSO foraging habitat since stand

growth will be accelerated resulting in older seral stages earlier than if left unthinned. Reducing tree density within foraging habitat will improve the owl's ability to forage within the stands as well as improve forest health and reduced fire risk. Thinning provides more sunlight to the forest floor for plant species used as food by key spotted owl prey species. Existing structural conditions will be maintained in order to support prey occurrence and abundance while allowing for rapid development of additional habitat parameters such as low shrub and forb growth. Current low-quality foraging habitat could develop into higher quality, more productive foraging habitat and even nesting/roosting habitat over time with the accelerated development of late successional characteristics (multi-layered conditions and large diameter trees with cavities and large limbs).

Fuels Reduction Treatments

One section of fuelbreak section (F07A) contains mid-mature stands of moderate quality NSO foraging habitat (approximately 6 acres). The fuelbreak treatment described Section IV of his document will occur within the first 50 feet (roadside). In the remaining 100 ft., 40-50% of existing brush will be maintained in a mosaic pattern for prey species cover. Overstocked trees <8" DBH will still be reduced and pruning of residual trees will still be allowed in these areas.

Approximately 191 acres of LQF will be modified through fuelbreak construction. Fuelbreaks would be created along high-use roads to assist in firefighting efforts and to protect existing NRF habitat within northern spotted owl territories from human caused fires. These prescriptions are designed to reduce ground fuels and the lower understory vegetation that create ladders for fire to climb into the canopy. Only brush and small diameter trees (8" DBH and less) will be removed in the fuelbreaks. No overstory trees will be removed and canopy will be maintained at least 40% cover in foraging habitat. Although multi-layered conditions contributing to foraging habitat would be slightly reduced by removing brush and understory trees, treatments would result in a greater assurance of long-term maintenance of suitable foraging habitat within the project area and reduce the risk that existing habitat will be lost due to fire.

The commercial thinning units will be hand piled and burned with some units having a follow-up understory burn. Of the 358 acres of LQF to be thinned, approximately 300 acres may be understory burned if conditions are within the required limits to maintain a low-intensity burn. Understory burning may also be used within fuelbreaks, including 167 acres of foraging habitat. The primary objective of understory burning is to reduce ground fuels within fuelbreaks. Because of its low intensity, the burn is not uniform in nature creating a mosaic pattern within the stand. Effects of understory burning would be limited because of this patchiness leaving interspaces of unburned forest floor. Foraging habitat will be modified as some understory shrubs and some small saplings would be killed and some smaller downed logs would be consumed from the burning in portions of the stand; however, current habitat function will be maintained. The results will be a more complex understory and forest floor that will benefit key prey species for the spotted owl such as the dusky-footed woodrat, while breaking up the continuity of the fuels in the understory to reduce flame length and spread of wildfire.

Understory burning is expected to reduce the quantity of downed woody material to various degrees regardless of the season of burning; however, snag and log numbers will

be maintained at levels designated in the Six Rivers LRMP. Generally, 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 and mainly in the smaller size classes. In some cases lines will be scratched around snags and existing downed wood.

Fuels treatments are not intended to homogenize habitats. Understory burning would occur under specific weather and moisture conditions designed to minimize damage to the residual stand, maintain snags and large down logs, and maintain about 50 percent of the duff layer (USFS Region 5 Soil Quality Standards and Guidelines). Dead and down materials are usually of large enough diameters that the logs are not burned completely and continue to provide key habitat features such as refugia and escape cover. Fuel moistures and humidity are monitored to assure that the prescriptions are met. Burn prescriptions are designed to prevent severe burn levels.

Burning could reduce prey species habitat temporarily in the immediate area, but is expected to be short-term leading to an overall increase of prey habitat post treatment. In addition, owls are known to forage within the burned areas once the understory vegetation begins to grow again (Ecology and Management of the Northern Spotted Owl, USDA-FS, 1985; Clark 2007, Bond 2009). Fuels reduction along high-use roads is expected to result in the protection and long-term maintenance of adjacent late-successional habitat by creating more fire resilient and fire-resistant forests.

Foraging Habitat Summary

Thinning and fuels reduction activities may modify foraging habitat through a short-term reduction of stand density; however, the habitat will remain suitable post project. Canopy closure will be maintained at 40 percent or greater, no predominant or dominant trees will be removed and large snags and downed wood would be maintained at the 80-100 percent level. Selected stands for thinning are considered low quality, with the potential to be improved through treatment. Treatments will be beneficial in the long term by creating stand conditions that benefit prey and accelerate the development of higher quality habitat in a shorter timeframe than would occur without treatment. This restoration and maintenance of habitat will aid in bringing these stands along in a manner consistent with pre-fire suppression era growth.

Northern Spotted Owl Activity Center Summary

Direct, indirect and cumulative effects were analyzed for nesting/roosting and foraging habitat. The Fish and Wildlife Service considers that the most activity occurs within 0.5 miles of the nest tree. Northern spotted owl territories with at least 400 acres of suitable habitat within 0.5 miles and 1,336 acres within 1.3 miles of the nest tree are generally thought to be more likely to be reproductively successful (USDI 2009).

Thresholds

The USFWS has determined minimum habitat thresholds, or the minimum amount of nesting/roosting (N/R) and foraging (F) habitat, that must be maintained in a territory within a specific distance from the core area of use in order for an NSO pair to persist at the site. Habitat removal below this minimum threshold may be considered “take” under

the Endangered Species Act (ESA). These habitat thresholds are also used to assess the relative condition of the activity center (AC). Six Rivers also uses the relative condition of an AC to evaluate the level of impact from habitat treatments (manipulating the habitat but maintaining habitat function) even though no take will occur.

The threshold for the home range is to maintain a minimum of 1336 acres of N/R and F within 1.3 miles, 400 acres within 0.5 mi and 936 between 0.5 and 1.3 miles of the activity center. The 0.5 mile is the core for nesting and the outer area, out to 1.3 mile, provides other elements critical to their life histories such as foraging. The USFWS has determined that the proportion and types of habitat to be maintained within the core area is very important in predicting NSO presence. The USFWS found that the highest use areas were within 0.5 mi of the nest and contained a combination of 48% nesting/roosting and 28% foraging habitat (USFWS 2009). Applying these percentages rounded up to the 0.5 mi scale results in the thresholds of 250 acres of nesting and roosting and 150 acres of foraging habitat. It is important to recognize the difference between the use of habitat thresholds in the determination of take under ESA versus descriptions of desired habitat conditions for conservation of NSO. Table 38 displays the current amount of NRF habitat within the Gordon activity centers.

Table 38. Current nesting/roosting and foraging habitat by Activity Center

AC #	AC Name	N/R habitat within 0.5 miles of AC	F habitat within 0.5 miles of AC	N/R habitat within 1.3 miles of AC	F habitat within 1.3 miles of AC
15	Craig's Creek	218	173	1169	1254
17	Coon Creek	270	108	1392	924
19	Gordon Creek	186	234	1769	1188
38	Fox Ridge	265	191	1369	1475
309	Redwood Creek	179	91	1280	1168
311	Haines Flat	180	287	1449	1196
368	Horse Flat	245	194	1325	1545
373	Canthook	152	56	1300	921

Two of the three landings and the two temporary roads occur within ACs (Table 39). All 3 actions will occur within the outer 1.3 mile radius of the 2 affected ACs. Neither of the 2 ACs are deficit in foraging habitat in the 1.3 mile home range. The maximum amount of foraging habitat that will be removed in any one Activity Center is 0.6 acre, with a maximum of 0.25 acre in any one area. The loss of habitat in any one area would be negligible and would resemble natural assemblages and small forest openings.

The total treatments within any one activity center will vary from 0 to 10% of the

available foraging habitat within 0.5 mile and 0.4 to 18% within 1.3 miles of the center (treatment acres/percentages within 1.3 mi include the acres within 0.5 mi) (Table 39). Only small amounts of foraging habitat would be lost due to new road and landing construction. A total of 0.97 acres foraging habitat removed within the action area, 0.6 acres maximum in any one AC. This loss would be negligible in any one given area and will resemble small forest openings after the roads and landings have been decommissioned.

No Activity Center would have thinning or fuelbreak treatments over 18% of the foraging habitat within any one activity center. Commercial thinning using variable density thinning techniques may modify foraging habitat but will maintain current habitat function immediately post-project. The project is expected to have beneficial effects by accelerating the development of forest structure to mature conditions more quickly than if left untreated, as well as reducing the risk of stand-replacing wild fire. Fuelbreaks within NRF habitat which restrict thinning to trees eight inches or less would be considered to be a much lighter treatment than commercial thinning.

Table 39. Proposed Treatments by Activity Center

Activity Centers	Habitat type	Thinning (comm, pct, or biomass)		Fuels treatments		Temporary roads and new construction		Landing construction		Total treatment acres	% Total treatment	Total treatment acres	% Total treatment
		0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	1.3 mi acres	0.5 mi acres	0.5 mi	1.3 mi acres	1.3 mi
368 Horse Flat	F				2							2.0	0.13(%)
	N/R			1	4					1.0	0.4(%)	5.0	0.4(%)
	Non												
373 Canthook	F												
	N/R				2							2.0	0.6 (%)
	Non	22	55										
15 Craig's Cr	F		33				0.1		0.5			33.6	2.7 (%)
	N/R												
	Non	42.5		87									
309 Redwood Cr	F		199		12							211	18(%)
	N/R												
	Non	30.5	145										
38 Fox Ridge	F												
	N/R			4	2					4.0	1.5 (%)	6.0	0.4 (%)
	Non		22										
17 Coon Cr	F		24	11	9.5					11.0	10 (%)	33.5	3.6(%)

	N/R												
	Non			42.5	124								
19 Gordon Cr	F		43		21.5		0.11 ac					43.11	3.6 (%)
	N/R												
	Non			2	109								
311 Haines Flat	F				21.5							21.5	1.8(%)
	N/R												
	Non		16		81.5								

All northern spotted owl activity centers in the Gordon project are within 2012 Critical Habitat except AC #309 (Redwood Creek).

All treated habitat will remain functional immediately post project. In addition, treatment of capable but currently unsuitable stands within the ACs will improve habitat conditions for the owls.

Direct and Indirect Effects of the Project on NSO Critical Habitat

Approximately 17, 899 acres of the Action Area occurs within the Unit 9, Klamath West Subunit 6 of the 2012 NSO Critical Habitat. There are 10 units to be commercially thinned (131 acres), 9 units to be precommercially thinned (200 acres), and 22 units (170 acres) of fuelbreak construction that will occur in NSO CHU. Commercial thinning will occur in 69 acres of LQF and 62 acres of dispersal-only habitat. Fuelbreak construction will occur in 12 acres of MQN/R, 65 acres of LQF, and approximately 105 acres of dispersal-only habitat. TSI will occur in 107 acres of dispersal-only habitat. A total of 12 acres of MQN/R, 134 acres of LQF, and 274 acres dispersal-only habitat will be modified but will maintain current habitat function within NSO CHU.

The proposed sugar pine restoration area contains large, predominant sugar pines that are being encroached upon by “dog-hair” thickets of small-diameter chinquapin and Douglas fir. The proposal is to remove all the small-diameter trees within the drip line of the pine, and thin the remaining stands. The pines are already showing signs of distress from the competition with the thickets of small diameter trees. The unit is in NSO CHU; however, the area does not contain suitable habitat for the NSO, and due to the poor quality of the soil it is unlikely to ever become suitable. The Six Rivers NF/Arcata FWS Office Level 1 Team conducted a field review of the stands in 2011 and determined that treating the sugar pine stands will not remove PCEs of CHU, and will have no effect on the CHU.

Note that all Primary Constituent Elements (PCE) discussed below occur in concert with PCE 1, which is coniferous forest types that support the NSO.

<u>Nesting/Roosting Habitat (PCE 2)</u>

Suitable N/R spotted owl habitat, as defined by the Forest Service, is composed of mature

timbered stands having multi-layered conditions, a canopy closure of 60% 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 conifer trees 21 inches or greater DBH and should comprise at least 40% of the total canopy closure. The Forest's local definition of N/R habitat also includes stands with overstory canopy closure of at least 40% because these stands typically have a hardwood understory which increases total canopy closure to 60% or greater.

Potential treatment units were selected by a silviculturalist from a vegetative data base and then field verified as to density and stand structure. Field verification was completed by the silviculturalist and wildlife biologist. All stands classified as late mature or old-growth were excluded from treatment. Mid-mature stands with predominant trees were ground verified as to whether they contained stand structure characteristics that would be classified as high quality nesting roosting habitat.

All high quality nesting/roosting habitat stands (mid-mature stands with mature forest characteristics and all mature and old growth) were dropped from treatment.

Of the 17,899 acres within the action area, 7,978 acres are suitable N/R habitat. Approximately 12 acres (0.15%) of the N/R habitat is proposed for fuels reduction treatments.

There would be no removal of N/R habitat due to commercial thinning or fuels reduction activities.

Fuels reduction activities may modify suitable NSO N/R PCE; however, the habitat will remain suitable post project. Only brush and small diameter trees will be removed within 50 ft. of a high-use road in NR.

Fuel reduction treatments are designed to reduce ground fuels and the lower understory vegetation that create ladders for fire to climb into the canopy. Treatments are limited to pruning lower branches of larger trees and removal of brush and small diameter trees 8” in diameter or less. No overstory trees would be removed, no overstory canopy would be reduced, no understory trees over 8” DBH would be removed, and snags and downed logs (20” DBH or greater) would be maintained unless they pose a safety hazard. Project-generated material would be hand piled and burned. The habitat would remain suitable post-project.

Fuel treatments are designed to reduce the risk of fire disturbance on a large scale. Although multi-layered conditions contributing to N/R PCEs would be slightly reduced by removing brush and understory trees (8” DBH or less) within 50 ft. of a road, treatments would result in a greater assurance of long-term maintenance of existing late-successional habitat within the action area. Fuel treatments in strategic areas along high-use roads would reduce the risk of fire ignitions along high use roads and provide greater protection to adjacent late-successional habitat. This will protect and enhance owl Critical Habitat in the long run.

Fuelbreak construction will modify 12 acres of low to moderate quality N/R habitat; however the habitat will be maintained as nesting and roosting habitat post-project. No PCEs will be removed through commercial thinning or fuels treatments.

Even though the treatment areas will remain suitable immediately post-treatment, 7,965.8

acres (99.9%) of suitable N/R habitat in the action area will remain untreated in this project.

Foraging Habitat (PCE 3)

The 2012 Critical Habitat Rule describes foraging habitat in the Klamath and Northern California Interior Coast Ranges Zone as having "very vegetative diversity" and that foraging-only habitat "for this zone showed greater divergence from nesting habitat, with much lower canopy cover and tree size." The Rule states that "habitats used for foraging northern spotted owls are much more variable than in northern portions of the species' range" and that "northern spotted owls will forage in younger stands and brushy openings with high prey densities and access to prey (Carey et al. 1992; Rosenberg and Anthony 1992; Thome et al. 1999; Irwin et al. 2012). Throughout much of the owl's range, the same habitat that provides for nesting and roosting also provides for foraging, although northern spotted owls have greater flexibility in utilizing a variety of habitats for foraging than they do for nesting and roosting."

Foraging habitat often has attributes similar to that of nesting and roosting habitat, but such habitat lacks specific nesting structures necessary to support successfully nesting pairs. It is often the younger stands that provide habitat for those early and mid-successional associated prey species that N/R does not offer. Foraging habitat is identified in the SRNF vegetation GIS layer, which uses the 11 inch DBH/40% canopy closure of the California Wildlife Habitat Relationship (CWHR) classification to define the lower end of this habitat type. Due to this many acres of conifer dominated stands are shown here as foraging habitat rather than as dispersal habitat.

Of the 6,995 acres of potential foraging habitat within Critical Habitat in the action area, approximately 134 acres of foraging PCE will be treated either through commercial thinning (69 acres) and fuels reduction treatments (65 acres), with 0.97 acres of LQF being removed for roads (2 temp roads for total of 0.15 mi or 0.22 acres) and landings (3 landings for total 0.75 acres). The treatments will maintain all components of foraging habitat, and will not remove PCEs except on those 0.97 acres. These will resemble small forest openings since new landing will average 0.25 acres. No more than 0.25 acres will be removed in any one area. These thinning treatments will accelerate the development of late-successional characteristics that favor northern spotted owls and protect existing suitable habitat. Temporary road width would be the minimum allowed, with minimal canopy loss. The loss of PCE in any one area would be negligible. All temporary roads and associated landings will be decommissioned after project activities are complete.

The stands within foraging habitat proposed for treatment are even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. These young stands have the potential to achieve rapid diameter and height growth with commercial thinning. Silvicultural prescriptions (such as group retention where areas within the stand that are left untreated) would ensure retention of existing stand structure, species composition, snags, and downed logs. Treatment will maintain functional habitat conditions within all currently suitable foraging, and is expected to improve conditions within the stands treated in the long term.

Thinning will have a positive impact to NSO foraging PCE since growth will be accelerated resulting in multi-layered, older seral stages earlier than if left unthinned.

Reducing tree density within foraging habitat will improve forest health and a reduced risk from fire. Existing structural conditions will be maintained in order to support prey occurrence and abundance while allowing for rapid development of replacement habitat. Replacement habitat could develop into nesting/roosting habitat over time. Some stands will be immediately improved upon completion of the treatment by allowing increased access to prey by the owl in the dense stands formerly refugia for the wood rat.

The commercial thinning units will be hand piled and burned with some units having a follow-up understory burn. Of the 65 acres of LQF to be thinned, approximately 52 acres may be understory burned if conditions are within the required limits to maintain a low-intensity burn. Understory burning may also be used within fuelbreaks, including the 65 acres of foraging habitat. The primary objective of understory burning is to reduce ground fuels within fuelbreaks. Because of its low intensity, the burn is not uniform in nature creating a mosaic pattern within the stand. Effects of understory burning would be limited because of this patchiness leaving interspaces of unburned forest floor. Foraging habitat will be modified as some understory shrubs and some small saplings would be killed and some smaller downed logs would be consumed from the burning in portions of the stand; however, current habitat function will be maintained. The results will be a more complex understory and forest floor that will benefit key prey species for the spotted owl such as the dusky-footed woodrat, while breaking up the continuity of the fuels in the understory to reduce flame length and spread of wildfire.

Burning would occur under specific weather and moisture conditions designed to minimize damage to the residual stand, maintain large woody debris and maintain about 50 percent of the duff layer. Burning could reduce prey species temporarily in the immediate area, but is expected to be a short-term effect.

Dead and down material are usually of large enough diameters that the logs are not burned completely and continue to provide key habitat features such as refugia and escape cover. In some areas, fuel treatments may be beneficial to the NSO in potential foraging habitat in CHU by opening thick sub-canopy vegetation, allowing increased access to prey. In addition, owls are known to forage within the burned areas once the understory vegetation begins to grow again

Fuel corridors would be created along major roads, mainly along ridge tops, to create a defensible space and safe access to assist in firefighting efforts and to protect existing NRF from human-caused fires. Fuel reduction treatments are designed to reduce ground fuels and the lower understory vegetation that create ladders for fire to climb into the canopy. Although multi-layered conditions contributing to foraging habitat would be slightly reduced by removing brush and understory trees (8” DBH or less) treatments would result in a greater assurance of long-term maintenance of suitable foraging and F PCE within the project area.

The project will modify approximately 134 acres of low quality foraging habitat PCE in fuels and thinning; however the habitat will be maintained as foraging habitat immediately post project.

Removal of PCEs for temporary road and landing construction will be minimal in any one area. No PCEs will be removed through commercial thinning or fuels treatments. The project design would ensure retention of existing stand structure, species

composition, snags, and downed logs. Canopy closure will be reduced in the short term, but will be maintained at a minimum of 40% closure. Foraging habitat function will be maintained immediately post-project. Treatment will maintain functional PCE conditions within all currently suitable foraging habitats and is expected to improve conditions within the stands treated in the long term. These treatments will accelerate the development of late-successional characteristics that favor northern spotted owls.

Dispersal Habitat (PCE 4)

The survivorship of northern spotted owls is likely greatest when dispersal habitat most closely resembles nesting, roosting, and foraging habitat, but owls may use other types of habitat for dispersal on a short-term basis. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy cover to provide protection from avian predators and at least minimal foraging opportunities. The minimum requirement for dispersal-only habitat is forests composed of at least 50 percent of trees with 11 inches DBH or greater and a minimum 40 percent canopy cover. Although NSO use N/R and F as dispersal habitat, here we define dispersal-only as conifer forest types that fall below the definition of foraging but still meet the criteria for dispersal.

Of the 1,392 acres of dispersal-only habitat within the project action area, approximately 274 acres will be treated (20% of the D-only habitat in the action area). These units are very low quality D habitat because they are densely stocked with little space for an owl to fly through. Thinning will reduce stand density; however post-treatment canopy cover will be maintained at 40% or greater. These stands will be immediately improved as dispersal habitat post treatment.

Approximately 0.25 acres of D-only habitat will be removed through landing construction. Removal of PCEs for landing construction will be minimal. Canopy closure in all other treatment areas will be maintained at a minimum of 40%. Thinning currently unsuitable stands of dense, young plantations is expected to provide additional dispersal habitat.

Even though all treatment areas will maintain their current habitat function and maintain a minimum of 40% canopy closure, approximately 80% of the dispersal-only habitat in the action area will not have any treatment. Since the NSO use NRF for dispersal as well, of the 16,365 acres of NRFD in the project areas approximately 98% of habitat suitable for dispersal will be left untreated in the action area.

Due to the negligible amount of habitat being removed on this project, effects to dispersal PCE will be insignificant.

Subunit KLW 6

Approximately 117, 541 acres of Unit 9, Klamath West Subunit 6 occurs on the Six Rivers National Forest with 41,448 acres on the Smith River NRA and 17, 899 acres within the Gordon Hill action area.

Noise and Smoke

Noise and smoke-generating activities that occur within or adjacent to suitable northern spotted owl habitat has the potential to disturb nesting owls. To avoid disturbance, design

features and limited operating periods (LOPs) would be implemented as described in the project design features in Section IV. The LOP from February 1 through July 31 will avoid impacts the NSO during the breeding season.

Direct Injury or Death

Surveys to the most current, USFWS approved-protocol have been conducted throughout the project area, and 8 northern spotted owl territories have been identified. No treatments will occur within the 70+-acre nest groves established around each known activity center and no activities will occur in high quality nesting/roosting habitat anywhere in the project area. Limited operating periods have been established for all activities within 0.25 miles of each activity center. Updated surveys will be maintained throughout the life of the project or additional limited operating periods will be implemented on activities within 0.25 miles of nesting/roosting habitat without up-to-date surveys. There is a low likelihood that direct injury or death could occur to an individual northern spotted owl during the implementation of the management activities.

The Forest conducted informal consultation on the Gordon Hill Project with the USFWS. The informal consultation process on the Six Rivers National Forest is conducted under the Level 1 Consultation process. The Level 1 process requires biologists from the US Forest Service and the USFWS to work together to identify potential impacts to listed species and, where possible, to propose mitigation measures that will minimize impacts to those species. The Forest Service has worked extensively with the USFWS to ensure that the Gordon Hill Project was designed to protect listed species and their Critical Habitat.

The Six Rivers Level 1 Team determined that the Gordon Hill Project may affect but is not likely to adversely affect the northern spotted owl, and it may affect but is not likely to adversely affect northern spotted owl critical habitat. The Level 1Team determined that the proposed prescriptions would improve conditions within the treated areas and would be beneficial to the NSO.

Marbled Murrelet (*Brachyramphus marmoratus)*

Status: Federally Threatened

Recovery Plan

The Recovery Plan for the Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California (USDI 1997) calls for the protection of habitat essential for recovery in larger contiguous, blocks; maintaining occupied habitat; and monitoring trends, productivity, and reproduction.

MAMU Nesting Habitat

Nesting habitat is characterized by stands of large trees (at least 19in DBH and 98ft tall). Trees must have large branches or deformities (≥4in in diameter and ≥33ft in height), usually covered with moss or lichen, for nest platforms. Nest platforms typically require moderate to high canopy closure (≥70%), which may come from the nest tree or surrounding trees (Hamer and Nelson 1995). Number of platforms, moss depth and vertical and horizontal cover of the nest appear to be key factors in MAMU nest site

selection (Nelson *et al*. 2006). Other factors include distance to openings (for stall landings and jump-off departures), predator numbers and distance to human disturbance. Most observations are below 2000 feet (610 m) elevation, with some detections at 2000-3000 feet (610-914 m). Nesting usually occurs within the fog belt in this region but detections have occurred in the drier, Douglas-fir dominated forests immediately east of the belt. The farthest inland nest in California was located 18 miles (29 km) from the ocean (Hamer and Nelson 1995).

There is 12,703 acres of suitable MAMU habitat in the Gordon Project Action Area. The Gordon Hill Project will treat approximately 12 acres of low to moderate quality MAMU habitat through fuelbreak construction.

MAMU Critical Habitat

Marbled Murrelet (MAMU) Critical Habitat was revised in 2009 with a final rule published on October 5, 2011 (USDI 2011b). Located primarily on Federal land, and to a lesser extent on State, county, city and private lands, this final critical habitat rule provides protection requirements under section 7 of the Endangered Species Act for federally regulated activities.

A designation of critical habitat identifies areas essential to conservation of a species. The USFWS has determined that the physical and biological habitat features (referred to as the primary constituent elements) associated with the terrestrial environment that support nesting, roosting, and other normal behaviors are essential to the conservation of the MAMU and require special management considerations. Within areas essential for successful MAMU nesting, the USFWS has focused on the following primary constituent elements: 1) individual trees with potential nesting platforms, and 2) forested areas within 0.8 kilometers (0.5 miles) of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height. This includes all such forest, regardless of contiguity. These primary constituent elements are essential to provide and support suitable nesting habitat for successful reproduction of the marbled murrelet. Within the boundaries of designated critical habitat, only those areas that contain one or more primary constituent element are, by definition, critical habitat.

There are 22,672 acres of MAMU critical habitat within the planning area (CHU #CA-01b). Approximately 1,251 acres of the Gordon Hill Project occur in MAMU Critical Habitat; 468 acres of commercial thinning, 329 acres of TSI, 384 acres of shaded fuelbreak, 59 acres of Jeffrey pine grassland restoration and 16 acres of Sugar Pine restoration. The majority of units do not occur in suitable MAMU habitat. Approximately 12 acres of low to moderate quality MAMU habitat will be treated in MAMU CHU. There is 7,081 acres of suitable habitat in CHU in the Gordon Project planning area.

MAMU Status in Gordon Hill Project Area

No audio-visual surveys have conducted specifically for the MAMU in the project area; however, audio-visual surveys have been conducted along South Fork road (to the west of the project area) and for the 2008 Big Flat project (adjacent to the Gordon Project and to the southwest of the suitable habitat being treated). In 2010 and 2011, a radar study

was conducted along the western edge of the forest, including to the west of the Gordon Hill Project. There were recorded 14 murrelet-like detections in 2010 and 17 murrelet-like detections in 2011 on the SRNRA (Blaha and Cooper, 2011). There were no audio-visual observations to confirm these, however, a suite of characteristics were used to minimize contamination of the dataset. These detections are considered valid. These detections occurred in the Rowdy Creek drainage in the northwestern corner of the NRA and Blue Creek drainage on the southern end of the NRA. There were no detections in the Gordon Hill planning area. It is unlikely that MAMU are nesting in the project area; however no stand-specific audio-visual surveys were conducted. A limited operating period of March 24 to August 5th will be imposed on all noise and smoke generating activities within 0.25 miles of high quality MAMU nesting habitat

Direct and Indirect Effects of the Proposed Action

Nesting Habitat Removal

No MAMU nesting habitat will be removed for this project.

Commercial Thinning

No MAMU nesting habitat will be commercially thinned.

Nesting Habitat Maintenance

Portions of 11 sections of the fuelbreak (F01A, F03A, F08B, F09B, and F-40A through F-46A) occur in high quality nesting (HQN) habitat. The portions of F01A, F03A, F08B, and F09B that occur in HQN all occur in Riparian Reserves and will not have any treatment. In some cases, the fuelbreak will be shifted to the other side of the road (out of the RR and out of HQN) to maintain continuity. The units F40A through F46A occur along County Road 405 and Hurdygurdy Creek. The highest quality habitat occurs on the south side of Rd 405 along the creek, which will not have any treatment. The fuelbreak units on the north side of 405 contain from pole/early mature to small patches of late mature seral stages in varying locations and amounts. To take the most conservative approach, the entire area is considered to be moderate quality nesting (MQN) habitat.

The total acreage for fuelbreak units F40A through F46A is 73 acres; however half of the fuelbreak occurs in the Hurdygurdy Creek RR and will not be treated. Of the remaining 36.5 acres, only the first 50 feet within N habitat will be treated. This results in a fuelbreak construction in approximately 12 acres of MQN habitat. Since sections of this approximately 2 mile long area of fuelbreak occur in younger stands, 12 acres overestimates the amount of MAMU nesting habitat being treated.

Fuels reduction treatments may modify 12 acres of MQN habitat through the removal of brush and small diameter trees (8” DBH or less) within 50 ft. of the road; however, all existing habitat characteristics for nesting would be maintained and the stands would still function as nesting habitat immediately post-project. Overstory canopy will not be reduced; therefore, all potential nest trees and interlocking canopy around the potential nest trees will be maintained. Of the 12,703 acres of nesting habitat within the action area, approximately 12 acres of moderate quality nesting habitat would be treated. The amount of nesting habitat within the action area proposed for treatment would be

approximately 0.09% percent (99.91% N/R in the action area will not receive any treatment).

Strategically located fuelbreaks would reduce the risk of human-caused fire ignitions along high-use Forest and County roads and provide greater protection to existing late-successional habitat in the Gordon Hill Project area. Fuel reduction treatments are designed to protect existing habitat characteristics while reducing ground and ladder fuels and creating a defensible space to be used in defense of wildfires. Treatments are limited to pruning lower branches of larger trees and removal of brush and small diameter trees 8 "DBH or less. No overstory trees would be removed, no overstory canopy would be reduced, no understory trees over 8 inches would be removed for a fuels treatment, and large snags and downed wood would be maintained at the 80-100 percent level. Cut material in nesting habitat will be hand piled and burned. The habitat would remain suitable immediately post project.

Noise and Smoke

Noise and smoke-generating activities that occur within or adjacent to suitable MAMU nesting habitat has the potential to disturb nesting MAMU. Radar surveys for the marbled murrelet (MAMU) have been conducted, with no detections. It is unlikely that MAMU are nesting in the project area; however no stand-specific audio-visual surveys were conducted. A limited operating period of March 24 to August 5th will be imposed on all noise and smoke generating activities within 0.25 miles of high quality MAMU nesting habitat. If MAMU are subsequently detected in or adjacent to the project area, LOPs as described in the project design features will be imposed within 0.25 miles of the occupied site.

Direct Injury or Death

Surveys for the marbled murrelet (MAMU) have been conducted, with no detections. No treatments will occur within high quality nesting habitat anywhere in the project area and only brush and small diameter tress (8" or less) will be removed within 50 ft. of a high use road in MQN habitat. There is a low likelihood that direct injury or death could occur to an individual MAMU during the implementation of the management activities.

The Six Rivers Level 1 Team determined that the Gordon Hill Project may affect but is not likely to adversely affect the marbled murrelet, and it may affect but is not likely to adversely affect marbled murrelet critical habitat. The Level 1Team determined that the proposed prescriptions would improve conditions within the treated areas and would be beneficial to the MAMU in the long term.

Proposed Species

California Wolverine (*Gulo gulo luteus*)

In North America, wolverines occur within a wide variety of alpine, boreal, and arctic habitats, including boreal forests, tundra, and western mountains throughout Alaska and Canada. The southern portion of the species' range extends into the contiguous United States, including high-elevation alpine portions of Washington, Idaho, Montana, Wyoming, California, and Colorado (USFWS 2011c). Wolverines do not appear to specialize on specific vegetation or geological habitat aspects, but instead select areas

that are cold and receive enough winter precipitation to reliably maintain deep persistent snow late into the warm season (USFWS 2011c). The requirement of cold, snowy conditions means that, in the southern portion of the species' range where ambient temperatures are warmest, wolverine distribution is restricted to high elevations, while at more northerly latitudes; wolverines are present at lower elevations and even at sea level in the far north (USFWS 2011c).

Female wolverines use natal dens that are excavated in snow. Consistent snow cover greater than 5 feet deep appears to be a requirement for natal denning, because it provides security for offspring and buffers cold winter temperatures. Deep, persistent, and reliable spring snow cover (April 15 to May 14) is the best overall predictor of wolverine occurrence in the contiguous United States (USFWS 2011c).

There are no verified records of wolverine on the Forest: however, incidental sightings of wolverines have been reported on the NRA. Most of the sightings occurred in the 1970's and 80's. Considering their need for persistent spring snow cover, preference for subalpine and alpine habitats or climatic conditions and their aversion to human disturbance, wolverines are only likely to occur on the NRA at higher elevation area in the Siskiyou Wilderness.

The planning area is predominantly low elevation, and does not provide the deep, persistent, and reliable spring snow cover needed by breeding wolverine. Surveys were conducted in the Gordon Hill project area in 2010 through 2013 using camera stations. No wolverines were detected. The project will not impact wolverine.

Forest 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 would have no impact on certain Forest Service Sensitive species, based on either the lack of habitat, lack of detections during surveys, or the fact that habitat would not be impacted. Species that would not be affected by this project include the bald eagle (*Haliaeetus leucocephalus*), Townsend's big-eared bat (*Corynorthinus townsendii*), fringed myotis (*Myotis thysanodes*), western bumblebee *(Bombus occidentalis)*, western pond turtle (*Clemmys marmorata*), foothill yellow-legged frog (*Rana boylii*) southern torrent salamander (*Rhyacotriton variegatus*), 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.

Pacific fisher *(Martes pennanti pacifica)* **Also a Federal Candidate Species**

In northern California, fishers occupy mid-elevation, multi-storied mature and old-growth conifer, mixed conifer and mixed-conifer hardwood forests with contiguous canopy cover. Closed canopies (>50%) are typically selected but fishers will use areas of low to moderate canopy cover (25-40%) if there is sufficient understory (Lofroth et al. 2010). They do not occur in high-elevation alpine or subalpine habitats.

Foraging habitat varies with primary prey species. Since fishers in California prey

primarily on small to medium-sized mammals (woodrats, squirrels etc.) they will use forests with hardwood components which provide mast for prey, structurally complex structures near the forest floor (brushy understories) and high abundance of downed, woody debris (Lofroth et al. 2010).

Rest sites are strongly associated with moderate to dense forest canopy and elements of late-successional forests (Lofroth et al. 2010). Rest sites in northern California typically have >50% canopy cover and an average DBH of 30-45in for the 5 largest trees in the immediate area. These areas will often have a higher density of snags and large downed wood. Due to high temperatures, rest sites in this region often occur in the bottom of drainages or within 100m of water. Cavities, mistletoe blooms, branch deformities and platforms in live trees and snags (conifers and hardwoods) are used for rest sites as well as logs, rock areas, brush piles and concentrations of downed woody debris.

Cavities in live trees and snags are critical for reproduction. Females use cavities in a variety of tree species (Douglas fir, Ponderosa pine, Black oak etc.) but live hardwoods appear to be particularly important in northern California. Most cavities used as natal and weaning dens are formed from heartwood decay and are in large (average 36in DBH) trees and snags. These trees are often much older than those available with Douglas fir averaging 177 years (Lofroth et al. 2010).

Thompson et al. (2007) determined that based on data from a 1994-1995 soot track plate study, a 1996-1997 telemetry study, and a 2002-2003 mark-site study, fishers appear to be abundant and well distributed across “the managed forests of extreme northwest California”. An exact population estimate and distribution for the Forest are still unknown.

Systematic surveys occurred across the Forest in 1999 (Carroll et al 1999) show the highest probability of detections centered on the Trinity River, with detection probability decreasing the farther north and south you go.

Surveys were conducted in the Gordon Hill project area in 2010 through 2013 using camera stations. Fisher were detected in three areas. Two incidental sightings have also been recorded. No dens sites have been found.

The Gordon Hill Project will treat 12 acres of moderate quality denning habitat and 555 acres of potential foraging habitat. The 12 acres of denning habitat, 6 acres potential MQF and 191 acres of potential LQF will be modified through the creation of a shaded fuelbreak and 358 acres of potential foraging will be modified through commercial thinning.

Direct and indirect Effects of the Proposed Action

Denning Habitat Removal

No fisher denning habitat will be removed for this project.

Commercial Thinning

No fisher denning habitat will be commercially thinned.

Denning Habitat Maintenance

Portions of 11 sections of the fuelbreak (F01A, F03A, F08B, F09B, and F-40A through F-46A) occur in high quality denning habitat. The portions of F01A, F03A, F08B, and F09B that occur in HQ denning all occur in Riparian Reserves and will not have any treatment. In some cases, the fuelbreak will be shifted to the other side of the road (out of the RR and out of HQ denning) to maintain continuity. The units F40A through F46A occur along County Road 405 and Hurdygurdy Creek. The highest quality habitat occurs on the south side of Rd 405 along the creek, which will not have any treatment. The fuelbreak units on the north side of 405 contain from pole/early mature to small patches of late mature seral stages in varying locations and amounts. To take the most conservative approach, the entire area is considered to be moderate quality denning habitat.

The total acreage for fuelbreak units F40A through F46A is 73 acres; however half of the fuelbreak occurs in the Hurdygurdy Creek RR and will not be treated. Of the remaining 36.5 acres, only the first 50 feet within denning habitat will be treated. This results in a fuelbreak construction in approximately 12 acres of MQ denning habitat. Since sections of this approximately 2 mile long area of fuelbreak occur in younger stands, 12 acres overestimates the amount of fisher habitat being treated.

Fuels reduction treatments may modify 12 acres of MQ habitat through the removal of brush and small diameter trees (8” DBH or less) within 50 ft. of the road; however, all existing habitat characteristics for denning would be maintained and the stands would still function as denning habitat immediately post-project. Overstory canopy will not be reduced, canopy will be maintained, and riparian areas will not be treated. Of the 15,664 acres of fisher denning habitat within the action area, approximately 12 acres of moderate quality habitat would be treated. The amount of fisher denning habitat within the planning area proposed for treatment would be approximately 0.07% percent (99.93% of the denning habitat in the action area will not receive any treatment).

Strategically located fuelbreaks would reduce the risk of human-caused fire ignitions along high-use County roads and provide greater protection to existing late-successional habitat in the Gordon Hill Project area. Fuel reduction treatments are designed to protect existing habitat characteristics while reducing ground and ladder fuels and creating a defensible space to be used in defense of wildfires. Treatments are limited to pruning lower branches of larger trees and removal of brush and small diameter trees 8 “DBH or less. No overstory trees would be removed, no overstory canopy would be reduced, no understory trees over 8 inches would be removed for a fuels treatment, and large snags and downed wood would be maintained at the 80-100 percent level. Cut material in denning habitat will be hand piled and burned. The habitat would remain suitable immediately post project.

Foraging Habitat

The potential foraging habitat selected for treatment in the Gordon Hill Project is lacking diversity of species and sizes as well as structural components such as snags, downed wood and decadent structures such as large limbs, broken tops, and cavities.

There are 14,958 acres of potential foraging habitat in the action area. Of the 555 acres of

foraging being treated, 6 acres of MQF and 191 acres of LQF will be modified through the creation of a shaded fuelbreak and 358 acres will be modified through commercial thinning. Approximately 4% of the potential foraging habitat in the action area will receive treatment.

Fisher will also forage in denning habitat. There are 15,664 acres of denning habitat and 14,958 of potential foraging habitat the action area. It is expected that current habitat function will be maintained in all treatment areas immediately post-project (as was seen in the post-treatment Level 1 Team review of the Beaverslide Project treated in 2012 which implemented similar prescriptions); however, approximately 98.6% of the habitat in the action area will not have any treatment. The project will develop functional prey habitat that is currently lacking in the stands and should lead to higher survival and reproduction rates for the fisher.

Commercial Thinning

Approximately 358 acres of potential foraging habitat would be commercially thinned. The treatments would occur in even-aged young stands that are in early seral stages of development.

Treatments would consist of variable density thinning. The general prescription would be commercial thinning from below down to between 40 and 60% or greater canopy cover, although this would be highly variable. Variable basal area retention would be used to create gaps to promote horizontal diversity through the development of understory trees, while in other areas clumps of trees would be maintained to promote the development of snags. Individual trees with high potential for rapid growth would be widely spaced to accelerate diameter and height growth with the expectation of achieving vertical diversity. These trees are also expected to develop wide crowns and large limbs. No predominant trees would be removed. Existing snags (20” DBH or greater) and downed logs (20” diameter or greater and 10 feet long) would be maintained unless they pose a safety hazard or reduce the effectiveness of the shaded fuelbreaks.

The stands selected for treatment minimally met the definition of foraging habitat, but have a lower likelihood contributing to survivorship or reproduction. The stands have the tree diameter size and canopy cover of suitable habitat, but lack other important characteristics (such as multi-layered conditions that provide for prey species) that reduce their likelihood of use. Treatments were designed to accelerate the development of important habitat components currently lacking in the stands while retaining the existing structural elements, resulting in high restoration benefits. The project will improve habitat conditions and restore high quality habitat for the fisher. In the long-term, the treatments should improve habitat conditions by accelerating the development of important stand attributes (e.g., multi-storied stands and large-diameter trees with large crowns).

The stands proposed for treatment are generally even-aged and lack the horizontal and vertical diversity components associated with late-mature stands. These young stands have the potential to achieve rapid diameter and height growth with commercial thinning. As these stands develop, the acres suitable for fisher and other late-successional associated species should increase. By treating currently unsuitable habitat adjacent to existing late-successional habitat, larger patches would develop. Silvicultural prescriptions can be applied to these stands in order to accelerate their development

toward late seral conditions. These treatments can increase the amount of late seral vegetation quicker than would occur naturally. Treatments would change the stand structure and allow large trees to develop, promote development of an understory canopy, accelerating the development of functional late-successional habitat. Silvicultural prescriptions (such as group retention where areas within the stand are left untreated) would ensure retention of existing stand structure, species composition, snags, and downed logs.

Treatments will have a positive impact on fisher foraging habitat since stand growth will be accelerated resulting in older seral stages earlier than if left unthinned. Thinning provides more sunlight to the forest floor for plant species used as food by key prey species. Existing structural conditions will be maintained in order to support prey occurrence and abundance while allowing for rapid development of additional habitat parameters such as low shrub and forb growth. Current low-quality foraging habitat could develop into higher quality, more productive foraging habitat and even denning habitat over time with the accelerated development of late successional characteristics (multi-layered conditions and large diameter trees with cavities and large limbs).

Fuels Reduction Treatments

Approximately 197 acres of potential foraging habitat will be modified through fuelbreak construction. Fuelbreaks would be created along high-use roads to assist in firefighting efforts and to protect existing fisher denning habitat from human caused fires. These prescriptions are designed to reduce ground fuels and the lower understory vegetation that create ladders for fire to climb into the canopy. Only brush and small diameter trees (8” DBH and less) will be removed in the fuelbreaks. No overstory trees will be removed and canopy will be maintained at least 40% cover in foraging habitat. Although multi-layered conditions contributing to foraging habitat would be slightly reduced by removing brush and understory trees, treatments would result in a greater assurance of long-term maintenance of suitable foraging habitat within the project area and reduce the risk that said habitat will be lost due to fire. A no-treatment buffer has been delineated for all Riparian Areas.

The commercial thinning units will be hand piled and burned with some units having a follow-up understory burn. Of the 358 acres of potential foraging habitat to be thinned, approximately 300 acres may be understory burned if conditions are within the required limits to maintain a low-intensity burn. Understory burning may also be used within fuelbreaks, including 65 acres of potential foraging habitat. The primary objective of understory burning is to reduce ground fuels within fuelbreaks. Because of its low intensity, the burn is not uniform in nature creating a mosaic pattern within the stand. Effects of understory burning would be limited because of this patchiness leaving interspaces of unburned forest floor. Foraging habitat will be modified as some understory shrubs and some small saplings would be killed and some smaller downed logs would be consumed from the burning in portions of the stand; however, current habitat function will be maintained. The results will be a more complex understory and forest floor that will benefit key prey species for the fisher while breaking up the continuity of the fuels in the understory to reduce flame length and spread of wildfire.

Understory burning is expected to reduce the quantity of downed woody material to various degrees regardless of the season of burning; however, snag and log numbers will

be maintained at levels designated in the Six Rivers LRMP. Generally, 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 and mainly in the smaller size classes. In some cases lines will be scratched around snags and existing downed wood.

Fuels treatments are not intended to homogenize habitats. Understory burning would occur under specific weather and moisture conditions designed to minimize damage to the residual stand, maintain snags and large down logs, and maintain about 50 percent of the duff layer(USFS Region 5 Soil Quality Standards and Guidelines). Dead and down materials are usually of large enough diameters that the logs are not burned completely and continue to provide key habitat features such as refugia and escape cover. Fuel moistures and humidity are monitored to assure that the prescriptions are met. Burn prescriptions are designed to prevent severe burn levels.

Burning could reduce prey species habitat temporarily in the immediate area, but is expected to be short-term leading to an overall increase of prey habitat post treatment. Fuels reduction along high-use roads is expected to result in the protection and long-term maintenance of adjacent late-successional habitat by creating more fire resilient and fire-resistant forests.

Thinning and fuels reduction activities may modify foraging habitat through a short-term reduction of stand density; however, the habitat will remain suitable post project. Canopy closure will be maintained at 40 percent or greater, no predominant or dominant trees will be removed and large snags and downed wood would be maintained at the 80-100 percent level. Selected stands for thinning are considered low quality, with the potential to be improved through treatment. Treatments will be beneficial in the long term by creating stand conditions that benefit prey and accelerate the development of higher quality habitat in a shorter timeframe than would occur without treatment. This restoration and maintenance of habitat will aid in bringing these stands along in a manner consistent with pre-suppression era growth.

Noise and Smoke

Noise and smoke-generating activities that occur within or adjacent to occupied fisher denning habitat has the potential to disturb fisher. Surveys were conducted in the Gordon Hill project area in 2010 through 2013 using camera stations. Fisher were detected in three areas. Two incidental sightings have also been recorded. Although no den sites have been located, LOPs have been imposed for all noise and smoke generating activities within 0.25 miles of fisher suitable habitat around the detection sites.

Humboldt Marten (*Martes caurina*)

The subspecies of American marten that occurs on the NRA is the Humboldt marten (*Martes c. humboldtensis*). Humboldt martens utilize old growth Douglas fir stands on non-serpentine soils and late seral stage mixed-conifer (Douglas fir, sugar pine, western white pine and lodgepole pine) on serpentine soils (Slauson et al. 2007). Martens require a dense shrub layer (>60%) in both habitat types for foraging and concealment from

predators. Dominant shrub layer species include: salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), Pacific rhododendron (*Rhododendron macrophyllum*), huckleberry oak (*Quercus vaccinifolia*), and bush tanoak (*Lithocarpus densiflorus var. echinoides*) (Slauson and Zielinski, 2009).

Resting habitats consist of cavities in large trees, snags, stumps, or logs, as well as in woodpiles, rocky crevices and shrub clumps. Slauson and Zielinski (2009) reported large snags (DBH >35in) as the primary resting structure for Humboldt martens on non-serpentine soils. Resting structures also occurred on the ground in large (DBH >28in) conifer logs. On serpentine soils primary resting sites were located in rock and shrub clumps.

The first verified Humboldt marten in 50 years was detected in 1996 on the NRA (Zielinski and Golightly 1996, Zielinski et al 2001). Since then, survey work has been conducted using track plates, baited photograph stations and radio telemetry to determine the size and range of the population. The current occupied area is 267 square miles extending from the mouth of Rock Creek on the Smith River in the SNRA south to the Bluff Creek watershed on Orleans Ranger District, and east to the headwaters of Rock Creek drainage of the Klamath River in Siskiyou County (Slauson et al. 2009). This area encompasses lands on the Smith River National Recreation Area, Orleans Ranger District, Ukonom Ranger District, Redwood National and State parks, and private timber lands.

Direct and Indirect Effects of the Proposed Action

Suitable habitat for the marten occurs in the planning area. Surveys were conducted in the Gordon Hill Project area from 2010 through 2013. No marten were detected. Although treatments will occur in suitable habitat for the marten, it will remain suitable post-project. No predominant trees or overstory canopy will be removed and large hardwoods, large snags, and downed wood will be maintained. If marten are subsequently found within 0.25 miles of any treatment units, LOPs will be imposed. The project may impact individual marten, but will not cause a trend towards listing.

Northern Goshawk (*Accipiter gentilis*)

Goshawks are known to use mature forest habitats for nesting and foraging. Nesting stands are typically in dense pockets of large trees, often on north-facing, bench slopes near water. Foraging habitats are often more open to allow for the aerial ambush foraging strategy of the goshawk.

Historically, there have been numerous sightings of goshawks on the NRA, with at least three reproductive territories known to occur. However, the most recent territory was discovered in 1992. Comprehensive surveys of nest territories across the entire Forest in 1994 and 1995 determined that none of the nesting territories, or any of the suitable habitat within a one mile radius of the territories, were occupied. Additional surveys have been conducted on 45,000 to 50,000 acres (project-level surveys) with no detections. The status of the goshawk on the NRA is unknown at this time.

Goshawks occupy similar habitat to that of the NSO. There are approximately 14,528 acres of suitable fisher habitat in the Gordon Hill planning area. Surveys were conducted in the Gordon Hill Project area from 2010 through 2013. No goshawks were detected.

Direct and Indirect Effects of the Proposed Action

Suitable habitat for the goshawk occurs in the planning area. No predominant trees (potential nest trees) or overstory trees will be removed. Current canopy closure will be maintained. Removal of understory vegetation may improve foraging conditions for the goshawk. If nesting goshawks are subsequently found within 0.25 miles of any treatment units, LOPs will be imposed. The project may impact individual northern goshawk but will not cause a trend towards listing.

Mardon Skipper (*Polites mardon*)

The mardon skipper is a butterfly that inhabits early seral stage open grasslands that are dominated by short-statured grasses or sedges and forbs and are generally free of overstory trees and shrubs. Areas as small as 0.5 acres will support small populations of mardon skippers but most areas consist of mixed forest-grassland complexes with some connectivity between habitat patches for dispersal and movement of individuals. In northwestern California and southwestern Oregon, mardon skipper is found in small meadows (0.5-5 acres) dominated by Idaho fescue in sparse Jeffrey pine forests. Sites are 7-15 miles inland from the Pacific coast and range in elevation from 1,500-3,000ft. These sites are associated with serpentine based soils and are within the fog belt (USDI 2012).

The mardon skipper was petitioned for listing in 2002 and placed on the candidate list as "warranted but precluded" (evaluation delayed due to limited funding that was dedicated to court-ordered or higher priority listings). On September 4, 2012, the USFWS released a 12-month finding which determined that listing was not warranted at this time (USDI 2012c). An increased survey effort from 2003-2011 found an additional 165 sites which was a dramatic increase from the 14 documented sites in the 2002 petition.

There are two main population sites on the NRA, each containing multiple meadows. One of the sites is believed to be the largest population in California based on a one day count of 204 individuals in 2008 (Black & Mazzacano, 2010). This site is within the Gordon Hill planning areas (although no treatments will occur in the occupied habitat). Monitoring at these sites over the last 5 years indicate that populations at the sites on the NRA appear to be stable.

There are approximately 880 acres of potentially suitable habitat for Mardon skipper in the project area. Approximately 104 acres of potential habitat is proposed to be treated through burning to restore meadow conditions. None of the proposed treatment areas occur in occupied habitat.

Direct and Indirect Effects of the Proposed Action

This species is known to occur in the project area although none of the Jeffrey pine-grassland treatment units occur in the occupied area. The project is designed to restore habitat conditions for the butterfly in 104 acres of Jeffrey pine-grassland habitat. Although the sites are not currently occupied, burning will occur in fall outside of the flight season for the butterfly. Burning will be conducted under conditions that will result in a low intensity burn. The project may impact Mardon skippers, but will not cause a trend towards listing.

Management Indicator Species and Migratory Bird Species

Direct, indirect and cumulative effects to Management Indicator Species (MIS) and Migratory Bird Species (MBS) are disclosed in the MIS and MBS reports (Devlin-Craig and Owens 2014 and 2014a; located in the project file) and the results are summarized here. MIS and MBS were addressed based on their potential to occur within the project area based on habitat suitability, survey results, or incidental sighting records. Habitat suitability evaluations were made using the California Wildlife Habitat Relationships System, Version 8.0 software, developed by the California Department of Fish and Game. In addition habitat evaluations were made utilizing Six Rivers National Forest Wildlife Sighting Database, Six Rivers National Forest Vegetation Layer, field reviews, and Forest GIS vegetation layers.

No Action Alternative

Under the No Action alternative, no commercial or pre-commercial thinning, shaded fuelbreak construction, or fuel treatments would occur. The No Action alternative would not change the current conditions. No suitable habitat for any MIS or NTM species would be degraded through commercial thinning or shaded fuelbreak construction. However, the No Action alternative would not accelerate development of late-successional conditions in younger stands throughout the project area. The No Action alternative would also not reduce the fuels build-up in the project area or protect existing late successional habitat.

Proposed Action Alternative

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.

The Forest Land Management and Resource Plan for the Six Rivers National Forest use MIS to assess potential effects of project activities on the various habitats and habitat assemblages with which these species are associated. Forty-one fish and wildlife species have been selected as MIS or assemblages for a variety of habitats that are potentially affected by resource management activities on the Forest (LRMP IV-97).

The potential impacts to MIS were analyzed and the results are summarized here. The full report is located in the project file.

Seral stages in the project area range from shrub to mid-mature stands with small patches of late-mature and old growth. 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 in late-successional habitats, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80-100% of the average numbers found within mature and old growth stands within the Forest.

This project would degrade a total of 2555 acres of early seral stage habitat due to fuel break construction and commercial and pre-commercial thinning in early seral stands (shrub through early mature). For species that utilize early seral habitat (such as the lazuli bunting) this represents 9% of the early seral stage habitat in the project area.

No commercial harvest would occur in late-successional habitat; however shaded fuelbreak construction would occur in late-successional habitat along the main roads. Fuel treatments would occur in 12 acres that are considered suitable for late successional associated species. Fuel treatments would degrade approximately 0.08% of the suitable habitat for these species available in the project area. The shaded fuelbreak would be approximately 150 ft wide on either side of the road. Only brush and small diameter trees (less than 8” DBH) would be removed during any stage of the project. No overstory trees would be removed. All exiting snags and downed wood would be retained, unless the former poses a safety hazard. There would be minor habitat degradation for understory species such as the Pacific wren and ruffed grouse within the project areas through the removal of brush and small diameter (less than 8” DBH) trees; however in the long term, reduction of fuel ladders in these areas would improve adjacent habitat areas resilience to fire disturbance. Overstory canopy closure would be maintained, ground disturbance would be limited to existing roads and skid trails, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80-100% of the average numbers found within mature and old growth stands within the Forest.

All Riparian Reserves (RR) have a no-treatment buffer established of a minimum of 50ft in TSI and fuels units and 80ft in commercial thinning units, with equipment exclusion requirements in the remaining RR (approximately 160' total RR width). Little to no true riparian habitat exists within the units given the lack of riparian vegetation associated ephemeral and intermittent stream courses within the project area. However, in the long-term project implementation has the potential to improve riparian habitat conditions through the release of conifer and hardwoods/shrubs from thinning, generating a secondary canopy. The project would maintain high levels of coniferous canopy closure within the project area adjacent to RRs. Project activities would not occur within riparian habitat. Implementation of the project would maintain and improve riparian habitat conditions.

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% 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.

Understory burning the special habitat areas (Jeffrey pine grasslands) would reduce encroachment and protect the habitat in the long-term. MIS such as the black-tailed deer would benefit from burning these areas.

The Gordon Hill Vegetation Management Project would not adversely impact MIS. Although shaded fuelbreak construction would degrade habitat for species such as the Pacific wren and ruffed grouse, the majority of the project would improve/restore habitat conditions for all MIS by thinning (both commercial and precommercial) young, homogenous stands, accelerating the development of multi-storied conditions and other

late successional habitat characteristics. In addition, development of strategic fuelbreaks would help protect existing habitat from stand replacing fire.

MBS

The potential impacts to MBS 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.

Project design standards would minimize potential impacts to migratory species. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Although there would be minor habitat degradation for understory species through the removal of brush and small diameter (less than 8" DBH) trees, in the long term the reduction of fuel ladders in these areas would improve adjacent habitat areas resilience to fire disturbance. Overstory canopy closure would be maintained, ground disturbance would be limited to existing roads and skid trails, vegetation species diversity and composition would be maintained, and retention of snags and downed logs would be retained at 80-100% of the average numbers found within mature and old growth stands within the Forest.

Survey and Manage Species

Supporting details and information for this section can be found in the Survey and Manage Analysis for this project (Hoover and Devlin-Craig 2014). Application of the Survey and Manage Standards and Guidelines for this project is consistent with the Stipulated Agreement and Proposed Order in Conservation Northwest et al. v. Sherman, Case No. C08-1067-JCC (W.D. Wash). The Stipulated Agreement reinstated the 2001 Survey and Manage Record of Decision (ROD) and added modifications. The Court filed approval of the resulting Settlement Agreement on July 6, 2011. The 2011 Settlement Agreement made the following modifications to the 2001 ROD: (A) acknowledged existing exemption categories (2006 Pechman Exemptions); (B) updated the 2001 Survey and Manage species list; and (C) established new exemption categories.

The Survey and Manage Standards and Guidelines (USDA/USDI 2001) were developed to benefit species closely associated with late-successional and old-growth forests. Species include plant (vascular and non-vascular), fungi, terrestrial mollusk, aquatic mollusk, and vertebrate species. The Survey and Manage provision for each species would apply to the range (or portion of the range) of that species, to the particular habitats where concerns exists for species' persistence, and where management activities are considered "habitat-disturbing" for that species (USDA/USDI 2001).

The 2011 Settlement Agreement made modifications to the 2001 ROD: (A) acknowledges existing exemption categories (2006 Pechman Exemptions); (B) updates the 2001 Survey and Manage species list; and (C) establishes new exe Reference for the following "Pechman exemptions):

The Pechman exemptions are provisions ordered by the court in *Northwest Ecosystem Alliance et al. v. Mark E. Rey et al.*, No. 04-844P, (W.D. Wash. October 10, 2006). These provisions remain intact under the most recent order by the court Conservation Northwest v. Sherman Case No. 08-CV-1067-JCC (W.D. Wash. July 6, 2011).

A. Thinning projects in stands younger than 80 years old;

B. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;

C. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement of large wood, channel and floodplain reconstruction, or removal of channel diversions; and

D. The portions of projects involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and manage requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph.

The Gordon Hill Vegetation and Fuels Management Project is wholly within the red tree vole (RTV) Mesic Zone. The majority of the Gordon Hill is exempt from pre-project surveys level surveys under Pechman exemptions A) Thinning projects in stands younger than 80 years old; and D) hazardous fuel treatments applying prescribed fire are used for noncommercial projects.

Commercial thinning will occur in 41 units on a total of 665 acres. Five of these units were identified as up to 80 years in age and therefore subject to pre-disturbance surveys for Oregon red tree vole (*Arborimus longicaudus*). Pre-disturbance surveys were conducted in August and September 2012 in units 2, 3, 17, 57 and 88 and yielded no evidence of Oregon red tree vole.

Cumulative Effects to TES, MIS, NTM, and other Wildlife Species

Regarding all the past impacts from land uses (mining, timber harvest, and road constructions), the Gordon hill Project will facilitate restoration by thinning plantations and young natural stands. The beneficial cumulative effects include the reduction of habitat fragmentation and the development of late-seral conditions.

For an in depth description of the Smith River NRA and its history also see “Smith River Ecosystem Analysis: Basin and Subbasin Analyses and Late-Successional Reserve Assessment” (USDA Forest Service 1995).

<u>Timber Harvest</u>

Timber harvest activities and the suppression of wildfire in the Smith basin has led to changes in seral stages and increases in fuels. This shift in seral stage distribution is highest in the tanoak and Douglas-fir series, due to harvest of commercially valuable old-growth Douglas-fir stands that began in the late 1950s. There has been a reduction in old-growth forests and an increase in shrub, pole, and early mature forests.

Most of this harvest activity was concentrated on the lower 1/3 slope in the Douglas-fir and tan oak series. Within the 46,164 acre action area, approximately 8,197 acres (18%) are now in the younger seral stages. Of the 8,197 acres, 7,089 acres occur in the tan oak with Douglas fir overstory series (32% of the series in the action area) and 1108 acres occur in Douglas fir series (11% of this series).

Since the 1990 NRA Act, the majority of the vegetation management projects have involved thinning plantations and young natural stands to accelerate the development of

late-successional characteristics for the benefit of fish and wildlife as well as to reduce fuel loading to protect existing late successional habitats.. Ecological restoration of upland and riparian habitats and processes can be accelerated with active management.

Mining

Past hydraulic mining, primarily for gold, altered certain stream channels, including Hurdygurdy, Craig's, and Coon Creeks. Hydraulic mining altered channels and riparian areas significantly. Huge volumes of hillslope sediment were washed down to riparian and streamside areas and large woody debris (LWD) was removed from the channel in order to mine alluvial gold deposits within the substrate and near the channel. The removal of LWD reduced habitat complexity, LWD recruitment potential, and the ability of the channel to store and route the introduced sediment. Much of the landscape where hydraulic mining occurred is recovering, and previously altered riparian stands in these areas are approaching 70 to 80 years and are beginning to provide Riparian Reserve functions.

Fire

Historical records and fire evidence show that fires regularly occurred in this area with a variety of fire frequencies and intensities. Both wildfires and their exclusion through aggressive suppression affect plant and animal habitat, including stand structure, number of standing snags, amount of large woody debris, soil organic matter content, nutrient availability, and erosion hazard.

The dramatic reduction in wildfire burn acreages over the last 80 years appears to have resulted in unnatural fuel profiles that are more continuous, both horizontally and vertically. Given this increased conifer density, future wildfires could become larger and more destructive than in the past.

In the prolonged absence of fire, and aggravated by other disturbance factors, these fire-adapted forests and grasslands have undergone significant changes in species composition and structure. Intermediate canopy layers and higher ground fuel loadings have developed which allow ground fires to reach the crown more easily, making fires more difficult to control. Young plantations now occupy most of the harvested old-growth sites within the project area. Early and mid seral stages of Douglas-fir are more susceptible to mortality by wildfire than older late seral stands. Thick, corky bark on the lower bole and roots of older trees protects the cambium from heat damage. In addition, the tall trees have their foliage concentrated on the upper bole, which makes it difficult for fire to reach the crown; however, trees are typically not free of lower branches until they are more than 100 years old (Hermann et al, 1990). Stands selected for treatment in project area are predominantly 80 years old or less.

The high stem densities in plantations and younger stands also results in greater fire risk. Fire suppression activities have significantly reduced the amount of fire over the past 50 years leaving high fuel loads in places which threaten the resiliency of the upland and riparian habitats in the event of a wildfire. In addition to these past activities, road building has cut across numerous riparian reserves and fragmented habitat in multiple locations throughout the project area which has the potential to alter the sediment routing within the riparian reserve.

Habitats

Approximately 8,197 acres has been harvested in the Action Area and approximately 7,345 acres occurs in vegetation types (pine stand, grasslands, etc.) that are not capable of becoming habitat for species such as the spotted owl. Approximately 14, 958 acres are considered potentially suitable foraging-only habitat (not suitable for nesting) for the owl, most of which occurs in early to mid-mature stands. These stands were typically generated from mining activities or large fires in the early 1900's. There are approximately 15,664 acres of habitat that is potentially suitable for nesting for species such as the NSO.

The trend for wildlife habitats on the NRA is towards recovery. Since the 1990 NRA Act, timber harvest on the NRA has been limited and geared towards habitat restoration (thinning in younger stands). Fuel treatments have been developed to help restore natural fire regimes and to protect existing habitats. Since the NRA Act in 1990, 884 acres have been thinned using silvicultural prescriptions designed to accelerate the development of late-successional habitat characteristics and 1,966 acres have had fuels reduction treatments completed to restore habitat through the reintroduction of fire and to protect existing late-successional habitat from stand-replacing fire. The Big Flat Vegetation Management and Fuels Reduction Project is currently being implemented and will improve habitat conditions on an additional 1084 acres (503 acres commercial thinning and 581 TSI) and protect existing habitat through fuels reduction on 735 acres. The Gordon Hill Vegetation Management and Fuels Reduction Project will improve habitat conditions on 1460 acres (commercial thinning and TSI) and protect existing habitat through fuels reduction on 1168 acres. Accelerating the development of late-successional characteristics, and protecting existing habitat, will move the area toward the historic range of variability of seral stages and reduce fragmentation of habitat, improving habitat conditions for TESP species.

Three of the eight activity centers in the Gordon Hill planning area also overlap the Big Flat Vegetation Management and Fuels Reduction Project planning area. Incorporating the entire home ranges for these three NSO has defined the Action Area and have been evaluated throughout this document. The combined effects of the Gordon Hill and Big Flat projects are displayed in the Tables 40 and 41 below.

Table 40. Combined treatments for Gordon Hill (GH) and Big Flat (BF) Projects in Foraging habitat by activity centers (AC) that overlap both projects

AC#	Acre Total for GH at 0.5 mi	Acre Total for GH at 1.3 mi	Acre Total for BF at 0.5 mi	Acre Total for BF at 1.3 mi	Acre Total for Both 0.5 mi	Acre Total for Both 1.3 mi	Acre Total Forage Habitat Avail 0.5 mi	Acre Total Forage Habitat Avail 1.3 mi	% Habitat Impact 0.5 mi	% Habitat Impact 1.3 mi
368	0	2	39	137	39	139	194	1545	20%	9%
373	0	0	0	159	0	159	56	921	0	17%
38	0	0	0	62	0	62	191	1475	0	4%

Table 41. Combined total treatments for Gordon Hill (GH) and Big Flat (BF) Projects in Nesting/Roosting habitat by activity center (AC) that overlap both projects

AC#	Acre Total for GH at 0.5 mi	Acre Total for GH at 1.3 mi	Acre Total for BF at 0.5 mi	Acre Total for BF 1.3 mi	Acre Total for Both 0.5 mi	Acre Total for Both 1.3 mi	Acre Total N/R Habitat Avail 0.5 mi	Acre Total N/R Habitat Avail 1.3 mi	% Habitat Impact 0.5 mi	% Habitat Impact 1.3 mi
368	1	4	0	0	1	5	245	1325	0.4%	2%
373	0	2	0	10	0	12	152	1300	0	0.9%
38	4	2	0	0	4	6	265	1369	1.5%	0.4%

The only treatments occurring in these 3 ACs for both projects is fuelbreak construction along high use roads. Only brush and small diameter trees (8" DBH or less) were or will be cut. No overstory trees were or will be removed and existing canopy was or will be maintained. Snags and downed logs were and will be maintained at the 80-100% level. All treated acres in both project is or will remain suitable immediately post project.

The maximum amount of acres treated within an AC for the two project combined is 2% of nesting/roosting and 20% of foraging. Although current habitat function has been or will be maintained in all treated areas, approximately 98% of the available nesting/roosting and 80% foraging will be left untreated and available as alternative habitat for the use by spotted owls.

All treatment areas in all vegetation management projects in the action area will remain suitable immediately post project. Treatments were designed to maintain and restore habitat function in low to moderate quality habitat in all project areas.

Post treatment monitoring was conduct on the Big Flat Vegetation Management and Fuels Reduction Project, as well as on similar projects elsewhere on the Forest. All the units exceeded canopy closure requirements, and protected predominant trees, snags, and downed logs. The units are still functional habitat and should respond well to the treatments. It was agreed by the Level 1 Team these types of treatments will have a beneficial effect on the future habitat conditions of the area and creating more alternative habitats for owls to use as additional treatments occur on the landscape.

Illegal Marijuana Cultivation

A current issues arising in the scientific community is the effect of illegal marijuana gardens on public and private lands. The use of rodenticide has been linked to death in the Pacific fisher and the northern spotted owl. The project area has had gardens in the past, and some may exist on private lands as well, although there has been less of this type of activity on the NRA than other areas of the Forest due to steep terrain and brushy conditions. It is uncertain how much cumulative impacts this will have on the owl at this time, but ongoing research has shown that there is greater risk to foraging Pacific fisher

because of its scavenging activities during parts of the year. The data on these impacts is just starting to be generated. Whether rodenticide use is impacting the population of fisher or owls is still to be determined.

Marijuana cultivation on Forest Service land is an illegal activity and therefore is beyond the Forest Service control. The Forest Service law enforcement actively searches for and removes any grow-sites found; however, it is unknown how many sites exist in the Forest. It is hoped that by treating these low quality stands and plantations that are not currently habitat that owls, fisher, and other species will have increased areas for foraging, and possibly help limit their exposure to the toxins that may be found in the forest from illegal activities.

Due to the scope, size, and intent of this project, there are no concerns of negative cumulative effects for TES, MIS, NTM, or other wildlife species. This proposed project is designed to attain 2011 Recovery NSO Plan, 2012 NSO Critical Habitat Rule, and LSR objectives and contains implicit measures to reverse cumulative watershed effects over the long term in the treated areas.

Botany

Forest Sensitive Species

Supporting and detailed information for this section can be found in the Biological Evaluation and Assessment (Hoover 2014a).

Pre-field Analysis

Pre-field analysis of the project area included review of the Forest Sensitive Species 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 activities would occur, elevation gradient of the project area, land-use history, and professional knowledge of Sensitive species habitat and distribution on the Forest. Surveys for the Gordon Project spanned multiple years starting in 2009 with final surveys concluding in 2012. Surveys incorporated the succession of species over the field season, from those emerging as early as mid-May to those most easily detectable in mid-late summer.

Approximately 55% of the units (CT, TSI, Restoration) and 50% of the fuels units/areas were considered unsuitable habitat for Sensitive species and therefore were not surveyed. Unsuitability related to seral stage, land-use history and resultant stand conditions; specifically those units/areas in the shrub-harvest, pole-harvest, early mature with harvest and early mature stands seral stages. Table 42 displays the stratification of units by seral stage. All of the units proposed for commercial treatment are in the early-mature, early with previous harvest or pole-harvest seral stages; all timber stand improvement units are in the early mature or pole harvest seral stages. Only fuels treatments would occur in stands mid-mature to late-mature.

Table 42. Proportion of Gordon Units (Fuels, CT and TSI) by Seral Stage

Seral Stage	Acres (% of all acres in project)
Pole Harvest, Early Mature, Early Harvest	84%
Early Mature/Mid-Mature combined	12%
Mid-Mature or Late-Mature	4%

Depending on stand structural and vegetation components, stands in the mid-mature seral stages were targeted for surveys for those Sensitive species associated with relatively older stands. Units slated for restoration activities, specifically in the Jeffrey pine-Douglas-fir/Huckleberry oak/California fescue, Jeffrey pine/Idaho fescue or Lodgepole/Western white pine were also targeted due to their association with ultramafic parent material—a parent material associated with an array of Sensitive plant species endemic to this parent material type. In contrast to species associated with mid-mature and older stands or certain plant associations occuring on ultramafic substrates, *Prosartes parvifolia*, a newly added Sensitive plant, species is known to occur in habitat settings ranging from shrublands to Douglas-fir forests. In order to target survey areas, species associates, seral stage, elevation, slope, and parent material associations were collated from the eight documented locations as well as species associations contained in the paper that described the species (Mesler et al. 2010). Known site visits were also conducted to gain better familiarity with the array of habitats that this species can occupy. Another guiding factor for stratifying the survey area was a majority of the known occurrences were associated with habitat openings and edges –bare areas between shrubs, skid roads, and roads.

Surveys were not conducted for any Sensitive fungi species. The reasons for not undertaking surveys range from the biology of fungal organisms, specifically the body being underground in the form of bundles of threads, called mycelium and the lack of reliable fruiting year to year to make surveys feasible, to 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.

Survey Results

Table 43 displays a summary of the survey results relative to units within the proposed action.

Table 43. Sensitive species detected or known to the project area

Species	Taxonomic Group	Units (F=fuels, JP restoration, TSI-timber sale improvement)
Lewisia oppostifolia	Vascular plant	JP Rest 59 (edge of unit), F 19A (2 sites)
Silene serpentinicola	Vascular plant	JP Rest 80 (2 sites), 81 (multiple sites)
Packera hesperia	Vascular plant	F-19B
Prosartes parvifolia	Vascular plant	F-12A, TSI- 47a

Lewisia oppositifolia

Lewisia oppositifolia (LEOP) is endemic to ultramafic habitats. In the project area, LEOP is associated with a fuelbreak and on the edge of a Jeffrey pine restoration unit. LEOP grows in relatively open, flat areas on peridotite soils (a type of ultramafic soil) that hold moisture during the spring and fall seasons. Habitat is described as barrens with cobbly soils in shallow depressions and benches that tend to remain saturated or puddled into spring. Patches of bare ground where it occurs is typically within the Jeffrey pine-Idaho fescue plant association or the lodgepole pine series.

LEOP is dormant and subterranean in summer and early fall following its spring reproductive period, therefore; the species has probably historically escaped most natural fires during its period of above-ground growth. In the Gordon Project, LEOP is found in small barren pockets in openings of lodgepole pine with low fuel build-up. These barren pockets also tend to be seasonally moister than the surrounding area. LEOP is a tap-rooted perennial with the root crown including the caudex (which is a thick, sometimes woody, stem of a perennial that is at or beneath the ground level) located about 2 inches deep below the soil surface (Carothers 2007), a depth which may afford some protection. These niche characteristics (e.g. bare surfaces, low fuels) along with the biology of the species (e.g. summer dormancy, buried root crown and caudex) may contribute to its survival during wildfires.

In regards to wildfire, the fire regime characteristics for the Jeffrey pine vegetation type of the Klamath Range are typically low to moderate intensity, occurring in the summer to fall season, with a relatively short median fire-return interval (i.e. 8- 30 years at a relatively high elevation site and 8-15 years at a lower elevation site) (Skinner et al. 2006, Taylor and Skinner 2003). Nutrient-poor ultramafic soils underlying the Jeffrey pine stands are not productive; therefore, growth of woody material is slow. The limiting environment of ultramafic soils can increase variability in fuel production and structure, which are factors that could lead to longer fire-return intervals in some places than is characteristic of other pine vegetation types (Taylor and Skinner 2003).

In order to gain some information about prescribed fire effects on LEOP, a study was conducted in association with the Coon Mountain Meadow Restoration Project (Moore 2005, Schreiber 2011a). Two seasons of pre-burn data were collected to serve as baseline. Low intensity prescribed burning was conducted in the fall (October) of 2008. The prescribed burn was allowed to mimic natural wildfire conditions as it burned, and of the 10 frames, only 2 frames were subjected to the fire and in those frames. Two years of post-fire monitoring resulted in little to no change in the number of LEOP plants in the frames. It is possible that fuel loading in the unburned frames was either not high enough to carry fire, or soil moisture at the time of burning was relatively high so as to prevent fire from carrying through the transects. LEOP occurs in a habitat that retains seasonal moisture longer than other areas and this may have contributed to the fact that fire did not carry into the transects.

In summary, issues to consider when evaluating environmental effects to LEOP relative to this project include: a. physical impacts to plants or habitat and b. season (relates to intensity) and frequency of burning.

Silene serpentinicola

Silene serpentinicola (SISE) was found two Jeffrey pine restoration units. SISE is endemic to the Smith River basin in northwest Del Norte County, California and Curry County in Oregon. It occurs in dry, gravelly to cobbly soils of ultramafic origin with little to no over story. In the project area the species was found in bare to gravelly patches in association with Jeffrey pine/Idaho fescue grasslands. The species is also documented in the western white pine-lodgepole pine vegetation association. Plants grow in open patches including those associated with road cut banks and in post-fire settings.

SISE is a tap rooted, herbaceous perennial with an underground caudex which branches beneath the soil surface; from these branches shoots develop. Reproductive plants typically flower between June and mid-July and may flower later into August depending on the season. Dormancy has been observed in other species of *Silene* (Lesica 1999).

The combination of habitat (open settings, often disturbed, rocky/little herbaceous), development of underground branches that further develop above-ground shoots, the reproductive period during the summer, and possibly periods of dormancy indicate that SISE's ecology, distribution and persistence in the landscape is likely associated with fire. Fire effect investigations on another Silene species, *S. spaldingii* indicated increased recruitment after prescribed fire, in particular spring burns, compared to the control (Lesica 1999). This study did occur in grassland settings considered more productive than those settings associated with SISE, so results may not be readily comparable but are corroborated by findings of seedling establishment of *Silene douglassii* after a wildfire in the dry, eastern Cascades, whereby seeds subject to wildfire as well as smoke exposed seeds germinated at a higher rate compared to controls (Lofflin and Kephart 2005).

In both units, there are localized, small occurrences of the invasive shrub scotch broom (*Cytisus scoparius*) that have been treated since detected. Monitoring of these sites in 2014 indicated no plants. However, given that the plants when treated were of reproductive age, there are likely seeds in the soil "bank" and the viability of scotch broom seed can extend for decades. The habit of most invasive is to spread as a result of ground disturbance (including fire) and in its wake, displace native plant species and native habitats.

In summary, issues to consider when evaluating effects to SISE relate primarily to a) physical impacts to plants and habitat, b) season and frequency of burning and c) if unmanaged, the potential spread of scotch broom into occupied habitat.

Packera hesperia

Packera hesperia (PAHE) was found in one small area in a fuel break. PAHE is a serpentine endemic known to the Illinois Valley area on the Siskiyou National Forest in Oregon in Josephine County, to the Grants Pass Resource Area of the Bureau of Land Management- Medford, and a few locations on private land in Oregon. Prior to surveys for Gordon, PAHE was only known to one location in California, at Lower Coon Mountain, on the Smith River National Recreation Area on the Six Rivers National

Forest in Del Norte County. The detection in Gordon is the southernmost occurrence of the species to date.

In California, the few documented locations of PAHE are associated primarily with the ultramafic Jeffrey Pine-Idaho Fescue plant association where it occurs in the grassland. In the project area, PAHE was found in similar open and grassy habitats but in the knobcone pine series with characteristic shrubs association with ultramafics such as huckleberry oak, pinemat manzanita and California coffeeberry. PAHE is a short-lived perennial within the sunflower family. Stems arise from a caudex. Flowering occurs in June and continues into July. Little is known about the life history of this species.

Kagen (1988) developed a species management guide for PAHE in which he identified vegetative succession and competition by an increasing cover of bunchgrasses (e.g. Idaho fescue) as a potential threat to the species. To expand upon the conservation concerns of vegetative succession overcoming PAHE, fire effects study was conducted on the Siskiyou National Forest in Oregon (Borgias 2001). The study site species assemblage was similar to that of Coon Mountain. The burn was conducted in September. Three years of post-burn monitoring indicated a decrease in reproductive plants of PAHE and acknowledges that as a perennial, it may take a few years for plants to become reproductive, so the decline in reproductive individuals may or may not have been an issue for the population.

In California, on Coon Mountain, a small-scale fire effects study was conducted in relation to an occurrence of PAHA and a proposed burning of Idaho fescue grasslands (Moore 2007). A fixed circular plot was monitored pre-burn to collect baseline and post-burn. Burning occurred in fall of 2008. Observations indicate fall burning did not result in declines in occurrence size in fact there was little to no difference between total number of plants in the burn and no-burn plots. The number of reproductive plants between the 2011 burn and no-burn sampling indicated a 65% increase; fall burning may have resulted in an increased reproductive capacity for PAHE at this occurrence (Schreiber 2011b).

Similar to SISE, the habitat for PAHE is vulnerable to the introduction and spread of invasive plant species, in this case, St. Johnswort (*Hypericum perforatum*). St. Johnswort occurs on the road edge, adjacent (within 50ft) of the grassy opening that supports PAHE. St John's wort can form dense stands after disturbance such as logging or fires and consequently displace native plant species.

Related to proposed activities in the Gordon Project, issues to consider when evaluating effects pertain to: a) physical impacts to plants and habitat, b) season and frequency of burning and c) potential spread of St. Johnswort into occupied habitat.

Prosartes parvifolia

Prosartes parvifolia (PRPA) was located in association with a fuelbreak and a in an opening associated with a TSI unit. The species is known to the Smith River watershed of the Siskiyou Mountains of northwestern California and southwestern Oregon, specifically Del Norte County in California and Curry and Josephine Counties in Oregon. There are six occurrences on the Six Rivers National Forest. The species is a habitat generalist, occupying forest understories, forest edges, roadside slopes, and logged or

burned sites (Mesler et al. 2010). Eight of the known occurrences on the Forest were visited by staff botanists and three of those corresponded with fuel treatment areas < 5 years old, two were roadside occurrences, and two were on temporary roads in timber harvest areas that had been slectively cut. The remaining occurrence was in a relatively high elevation site at 4,950 feet, open understory and canopy cover of approximately 40% in the Bear Basin Butte Botanical Area.

Related to the proposed activities in the Gordon Project, issues to consider when evaluating effects pertain to: a) physical impacts directly to the plants and b) season of burning.

Fungi: *Boletus pulcherrimus, Dendrocollybia racemosa, Otidea smithii, and Phaeocollybia olivaceae*

The fungi species considered in this project fall into three groups: saprobic, mycorrhizal and parasitic. *Otidea smithii* is saprobic meaning that it is a decomposer, thriving on the litter and duff of the forest floor. Litter saprobes, such as this species, can extend over a large area via mycelial networks. Relatively shady and moist to mesic mature stands with various sized litter (including some coarse woody debris) describe the habitat for saprobes. *Boletus pulcherrimus* and *Phaeocollybia olivacea* are mycorrhizal. Mycorrhizal fungi form interdependent relationships with their host tree or shrub, exchanging nutrients, mineral and water. *Dendrocollybia racemosa* is parasitic on decaying fungi. Of these fungi, all except for *Otidea smithii* have detections on Six Rivers National Forest and only *Dendrocollybia racemosa* with detections on the Smith River NRA based upon strategic survey efforts that begain in 2001 but most earnestly since 2005 in northern California.

Common to all of these fungal groups are habitat conditions characterized by shady, mature stands with conifer or hardwood hosts and ample organic substrate (e.g. leaf, needle, woody debris). The above-ground portion of the fungus is the sporocarp or fruiting body, upon which spores are produced. Spores are essentially the seeds of the fungus which can disperse in the wind. Underground are networks of fungal hyphae (strand-like structures) when grouped together form mycelium. The mycelium is the body of the fungal individual. These networks scavenge nutrients from the surrounding soils, acting as an extension to the root system. Hyphae can grow to infect nearby plant roots and can eventually connect neighboring plants. This network facilitates carbon transfer from the host to the fungus. Networks also facilitate water transfer (Bruns 1995).

Management that avoids high intensity burning, over story/understory clearing of refuge species and removal of forest floor components will best serve the retention of mycorrhizal community diversity (Wiensczyk, et al. 2002). Germane to prescribe fire is the burn interval planned. Although not studied in the forest types associated with this project, prescribed burning intervals can affect fine root biomass and thus mycorrhizal biomass (Hart et. al 2005); for example, a burn interval of less than two years heated host plants roots, resulting in a significant reduction in nutrient availability associated with mycorrhizal fungi (Bastias et al. 2006).

Retention of living refuge trees and shrubs (the host) retain the important underground linkages for mycorrhizal fungi--the myceliel network—which in turn will maintain habitat parameters for mycorrhizal species (Amaranthus and Perry 1994, Luoma et al.

2006). Likewise, management that retains over story canopy and the litter and coarse woody debris of the forest floor will maintain habitat parameters for saprobes (Norden et. al. 2004).

Issues to consider when evaluating effects to Sensitive fungi for the Gordon Project pertain to activities occurring in those portions of fuel breaks that occur in mid-mature and older stands and: a) extent of understory vegetation removal, b) burn intensity and c) burn interval.

No Action Alternative

For Sensitive fungi which occur in relatively old forests of relatively stable environments, the existing conditions may sustain the occurrences. For those species in open settings, the no action alternative may have other consequences. It is likely, over time, that without a wildfire or prescribed fire as proposed in the restoration or fuelbreak units of this project, that habitat conditions for *Lewisia oppositifolia*, *Silene serpentinicola*, and *Packera hesperia* would be negatively affected. These species tend to occur in open settings of ultramafic influence; vegetative succession could result in habitat infilling to the exclusion of these species without fire. Likewise for *Prosartes parvifoli*a, the species has a propensity for areas subject to disturbance and occurs in openings; therefore, lack of disturbance in the form of fire may result in plants being out-competed

Proposed Action Alternative

The measure of effect for Sensitive species is the extent to which habitat is altered by the various activities and the extent to which project design features would reduce or alleviate the effects of habitat alteration.

<u>Direct and Indirect Effects</u>

Lewisia oppositifolia, *Silene serpentinicola* and *Packera hesperia*

These species are either associated with the restoration units or fuelbreaks. Common activities to both include: cutting of small diameter trees/shrubs, pile burning, maintenance prescribed burning, and handline construction. Potential negative effects to these species as described above include direct impacts to the plants (i.e. hand line construction, pile burning in occupied habitat, use of machinery), high intensity pile burning, burning season, burning frequency and spread of invasive plants.

Project design features aim to reduce the risk of potential negative effects associated with these activities by:

- establishing buffers that exclude equipment and other ground disturbance,
- requiring burn piles to be located outside of the buffer or placed where vegetation is cut to alleviate concerns for increased ground temperatures where plants occur,
- burning during the season when plants are dormant,
- burning to maintain conditions at intervals in keeping with natural fire return intervals associated with plant associations on ultramafic substrate, and

- controlling the invasive plant species within specific units where these plants occur.

Prosartes parvifolia

One of the occurrences of this species was in a fuelbreak where cutting of vegetation, pile burning, maintenance burning and handline construction is planned. Potential negative effects to this species are those that would directly impact the plant through crushing or uprooting and possibly burn season. In TSI unit 47a, *Prosartes* occurs in an open area near what appears to be an old skid trail. In this case, the concern is the potential for direct impacts from logging-related activities.

Project design features aim to reduce the risk of potential negative effects associated with these activities by:

- establishing buffers that exclude equipment and other ground disturbance,
- in the fuel break unit, requiring burn piles to be located outside of the buffer or placed where vegetation is cut to alleviate concerns for increased ground temperatures where plants occur,
- burning during the season when plants are dormant.

Fungi: *Boletus pulcherrimus, Dendrocollybia racemosa, Otidea smithii, and Phaeocollybia olivaceae*

Potential habitat for these species is associated with a portions of the fuel break that coincide with mid-mature and older stands. Fuel break activities in mature forests focus on the forest floor, not the overstory, therefore called "shaded" fuel breaks which maintain the canopy and sub-canopy cover and remove small diameter trees and vegetation. Vegetation is manually cut and pile burned. Burns are prescribed for low intensity fires. Habitat components for fungi would be maintained in the retention of canopy and sub-canopy shading, and host trees in all applicable units. The Gordon Hill Project design feature to maintain a mosaic of vegetation in the understory (Chapter 2 Project Design Features, Wildlife #2) would further ensure forest floor shading and connectivity of the fungal mycelia by retaining host shrub species. Project design features associated with soil productivity and wildlife, specifically those related to retention of coarse woody debris, snags and logs contribute to reducing effects of activities to Sensitive fungi.

Cumulative Effects

Of the past activities corresponding to public land, mining and associated activities have likely had the most significant impact on those species associated with ultramafic parent materials (*L. oppositifolia*, *S. serpentinicola*, and *P. hesperia*). Exploratory mining in the North Fork Smith Watershed left road grids and pits that completely removed any vegetation but also fragmented the habitat. Past logging in the form of clearcutting, may have impacted *P. parvifolia* where it occurs with Douglas-fir but to what degree is unknown given the lack of historic information on the species distribution and its array of potential habitat (forest and open habitats). Past clear-cutting of mature forest across the Smith River NRA, including roughly 7,400 acres in the project area, has reduced the acres of this habitat type; thereby, negatively affecting potential Sensitive fungi species by notably changing various habitat components associated late-successional forests (e.g.

moderate to high canopy cover, forest stand structure, species composition). Relative to wildfire, all the species considered in this project have evolved under the historic fire regimes of the Klamath Region. Where the fire intervals have been altered by past suppression practices, resulting in relatively high intensity wildfire, the risk of cumulative effects is greatest on those species associated with forested habitats compared to ultramafic associated species. The Biscuit Wildfire of 2002 burned 500,000 acres of which most was underlain by ultramafic parent material. Although specific data on occurrences (e.g. occurrence size, reproductive classes) prior to 2002 was lacking on some of the occurrences, post-fire monitoring in 2005 of *Lewisia oppositifolia* and *Silene serpentinicola* did indicate that known sites of these species within the fire perimeter were extant after the wildfire.

The project area incorporates private land in the French Hill, Coon Mountain, Paradise Flat, and Tyson Mine areas. Private land activities include agriculture, domestic use, and timber harvest. Private lands for the most part have been previously disturbed—cleared, logged—therefore their suitability as Sensitive plant and fungi species has been compromised.

In regard to present and foreseeable future actions, project design features for vegetation and fuels projects in the form of buffering occupied habitat, altering activities within the buffer or excluding activities altogether, have been utilized (e.g. Coon Mountain Meadow Restoration Project, Gordon Hill Vegetation and Fuels Project); therefore reducing potentially adverse effects to the Sensitive species associated with that project, specifically, *Lewisia oppositifolia, Silene serpentinicola* and *Packera hesperia.*

Occurrences of *Lewisia* and *Silene* also correspond with the analysis area for the Smith River National Recreation Area Restoration and Motorized Travel Management Project (RMTM). Current planning for RMTM did not add any routes to the system that dissect occupied *Lewisia* habitat. Of concern is *Lewisia's* association with gentle slopes and the risk of illegal cross-country travel off of designated routes. Occurrences that are potentially vulnerable to cross-country travel from designated routes in RMTM are on Pine Flat Mountain (not within the planning area), representing 9% of the known population. *Silene* is more widespread in the analysis area and appears to have a tolerance for disturbance as evidenced by the presence of plants in the median and edge of non-system/unauthorized routes. Routes with *Silene* have been proposed for addition.as motorized trails. Preference for this setting may be due to reduced competition in a nutrient poor environment or morphological traits, such as vegetative reproduction in the form of rhizomes that afford some protection from current levels of all-terrain-vehicle use. It is conceivable that designating routes with *S. serpentinicola* occurring on travel surfaces could have both negative (crushing of reproductive plants, reducing recruitment) and beneficial (reducing competition from other herbaceous plants) effects to this species (McRae, J. 2014). Variables that could tilt the effects one way or the other is level of use beyond current levels and season of use.

Given that *Prosartes parvifolia* was recently described and not known to the Forest, surveys have only recently been conducted for this species in relation to Forest projects. One occurrence covering about 0.3 acres was associated with a past fuel break on French Hill Road and has persisted since project implementation around 2004. Project design features for this species in both the fuel break and in the TSI unit are to reduce direct effects to the species which appear to be greatest concern.

Present and foreseeable actions occurring in potential fungi habitat primarily pertain to

shaded fuel breaks in mature forest stands associated with the following projects. Shaded fuel breaks maintain the canopy and sub-canopy cover and remove small diameter trees and vegetation. Vegetation is manually cut and pile burned. Burns are prescribed for low intensity fires. Habitat components for fungi were maintained in the retention of canopy and sub-canopy shading, and host trees in all the projects. The Gordon Hill design feature to maintain a mosaic of vegetation in the understory (Appendix E- project design features) is relatively new and was added to better ensure forest floor shading and connectivity of the fungal mycelia—mycelia that utilize not just trees but shrubs such as *Vaccinium ovatum* (evergreen huckleberry), a common in the forest associate in the project area. While not incorporated into the initial treatment of the shaded fuel breaks (i.e. Big Flat Vegetation and Fuels Project), maintenance of 40-50% forest floor vegetation would be applied to future fuel break treatments whenever these areas coincide with mature forest.

For private land, timber harvest is expected to continue on the privately owned land within the project area; however, there are no known proposed Timber Harvest Plans being considered on non-Federal land parcels at this time. Other private land activities such as clearing for agricultural, buildings, or houses is likely to continue; however,the likelihood that Sensitive species occupy these settings is low.

In summary, for Sensitive fungi, past activities, specifically clearcutting, have reduced the amount of mature forest—available habitat for Sensitive fungi. Foreseeable future activities in mature forests will most likely be in the form of shaded fuelbreaks or thinnings that aim to retain canopy, stand structure and a mosaic of vegetation on the forest floor—habitat components upon which Sensitive fungi depend.

Ultramafic associated species have been impacted primarily by mining which clears and fragments the habitat. Fire suppression that has allowed for shrubs to fill in what was once bare or sparsely vegetated areas has likely had the most effect on *Prosartes parvifolia* and the ultramafic species, *Silene serpentinicola* and *Packera hesperia.* These species may not compete well with other plant species or their seeds need light/heat to germinate and are thus found in early successional habitats—habitats maintained by wildfire. For the foreseeable future activities that correspond to occupied habitat of the aforementioned species and *Lewisia oppositifolia*, project design features related to season of burning, use of hand treatments, managing invasive plants nearby….are expected to enhance habitat conditions for these ultramafic species. For *S. serpentinicola* and *L. oppositifolia*, the one foreseeable future activity that creates some concern for impacts to specific occurrences is related to the level of motorized travel on routes designated as a part of the RMTM project and illegal cross-country travel. If concerns are realized, occurrences could be impacted by the loss of individuals in the occurrence, yet cumulatively it is not expected that this loss would lead toward a trend in federal listing.

Survey and Manage Species-Plants

Supporting details and information for this section can be found in the Survey and Manage Analysis for this project (Hoover and Devlin-Craig 2014). Table 44 displays are the Survey and Manage (SM) plant species detected as a result of project surveys. Both are lichen species, *Lobaria oregana* and *Usnea longissima.*

Table 44. Survey and Manage Plants in the Gordon Hill Project

Species/UTMs Zone 10 NAD 83	**Units***	**Substrate**	**Setting/Habitat for Detection**
Lobaria oregana	TSI Unit 87, FB-13B and FB-43A	Douglas-fir 10" DBH, on bole/ Douglas-fir 25" DBH, on branches and as litterfall/ Douglas-fir 18" DBH, on bole	EM stand; tree adjacent to road/ LM stand, upslope from creek/ Grassy flat, creek bluff
Usnea longissima	JP Rest 78 (3 trees) & 81 (1 tree)	Douglas-fir ranging from 9" to 24" DBH/ Jeffrey pine, 15" DBH	Douglas-fir-Jeffrey pine grassland/ Single tree in middle of grassland

Lobaria oregana

Lobaria oregana, (LOOR) is a foliose lichen that in the Klamath Range of California is most often associated with legacy, old-growth or predominant trees in stands ranging in seral stage development from early to late-mature. On the Six Rivers National Forest, there are two known sites on the Orleans Ranger District which represent the eastern-most occurrence of this species documented on the Forest. The remaining occurrences are on the Smith River National Recreation Area, where the species occurs in the Shelley Creek Watershed, Myrtle Creek Watershed and in the Big Flat area (Hurdygurdy, Jones and Horse Creek watersheds).

As a lichen, LOOR exchanges water and gases through its "skin" and thus is influenced by changes in atmospheric moisture. Generally speaking, lichens are most susceptible to changes in their environment when the thallus is hydrated. In this condition, lichens are most photosynthetically active, contrarily, no gas exchange occurs in air-dried lichens (Nash 1996). Changes in atmospheric moisture and its effect on lichens are influenced by temperature. Lichens are well-adapted to temperatures experienced in their micro-habitat (Nash 1996), but tolerances to heat outside the natural range of variability can trigger a stress response in the lichen. In a dry state, lichens have a tremendous capacity to tolerate heat stress, but when hydrated that tolerance diminishes.

If observed in the canopy, LOOR is typically distributed on the inner portion of the branches close to the bole; however, position in the crown is influenced by environmental and micro-climatic conditions of a given geographic setting. The distribution of LOOR within and across stands depends on propagule availability and its ability to disperse. LOOR reproduces primarily by fragmentation, whereby pieces of the thallus (the body of the lichen) break off and become established on lower branches or other conifer trees in the sub-canopy, regardless of the age of the substrate. So while LOOR can become established on a variety of substrates if environmental conditions are favorable, its ability to disperse across and between stand is limited. In terms of environmental conditions,

factors that might play a role in the resiliency of LOOR under a given set of light conditions and thus its distribution in a tree or across a stand include seasonal temperature, adaptive capability of individuals in a population to adjust to differing environments (Shirazi et al. 1996) and oceanic or riverine influences.

Activities which remove or damage the substrate upon which LOOR is attached and growing, remove sub-canopy trees which serve as local sites for thalli fragment establishment, or alter the existing shade/lighting or atmospheric conditions beyond the threshold tolerated by LOOR, are those that could negatively affect the persistence of LOOR at a site.

Usnea longissima

Usnea longissima (USLO) is a filamentous, fruticose lichen that grows in canopy openings near areas of higher moisture, such as creeks, and can occur more inland in areas with periodic fog. USLO has a pendulous growth habit and grows in long strands, draping trees and shrubs. Main branches are almost undivided, and side branches are perpendicular and short to moderately long.

USLO is a circumboreal species. In North America, USLO occurs predominately along the northern Pacific Coast of North America from Alaska to northern California, where its distribution is limited and patchy (Keon and Muir 2002). There are approximately 34 known sites of USLO and all occur on the Smith River National Recreation Area.

Reproduction is primarily through fragmentation, whereby fragments of the thallus break and disperse to suitable substrate. As fragments, USLO can disperse short distances to the branches of sub-canopy conifers, hardwoods, and shrubs, raising the importance of the proximity of suitable substrate to the host tree or propagule source (Esseen et al. 1981). This short-distance dispersal may possibly explain the patchy distribution of biomass accumulation across a stand. Dispersal distance may be increased beyond an immediate tree to local substrate dispersal by prevailing and oft strong winds and open settings, such as those associated with riverine and riparian corridors.

Throughout its range from California to Washington, USLO occurs in late-successional conifer stands with hardwood associates and in riparian areas; however, investigations have shown that thalli can grow and thrive in habitats predicted to be the least suitable (Keon and Muir 2002). This was indicated by the survey results in Gordon, where USLO was located on individual mature Douglas-firs in the open setting of Jeffrey pine/Idaho fescue woodlands. The grassland openings in the project area were surrounded by mature Douglas-fir/hardwood dominated stands which may have served as the “parent” or inoculum source for the thalli in the opening.

The proposed activity for the units where USLO occurs that may affect the species is prescribed fire. As a filamentous, fruticose lichen, the structure of USLO maintains a high surface-to-volume ratio, higher even compared to needles, grass and evergreen shrubs (Rundel 1981). These high surface-to-volume ratios allow for more rapid drying and wetting (Nash 1996); however, as a consequence, during the dry stage, USLO would be flammable if exposed to fire (Auclair 1983). In addition, due to its biology and other characteristics of the species (e.g. filamentous morphology and high surface-to-volume ratio), USLO is vulnerable to changes in the quality of atmospheric condition. Physiological reactions may include loss of membrane integrity and breakdown of pigment (Nash 1996), in addition to necrosis and death.

Thalli (the body of the organism) threads can fragment from an occupy tree and fall to understory small trees or spread to other substrates via wind-blown fragments. Activities which completely clear the trees in the understory of the occupied tree, can remove potential substrate for future recruitment. Pile burning activities are a concern due to changes in atmospheric conditions, increased heat and potential ignition of lichen thalli. Smoke generated during burning, especially during the wet season, when the lichen is photosynthetically active, can change the atmospheric quality to the detriment of USLO.

No Action Alternative

The no action alternative would maintain the occupied substrate of LOOR and USLO therefore; there are no direct effects to these species. This alternative would also maintain existing environmental conditions for these species thus eliminating any potential indirect effects caused by understory or pile burning or removal of sub-canopy trees that provide shading to the lower crown of the substrate tree and provide potential dispersal sites.

Proposed Action Alternative

The measure of effect for these Survey and Manage lichen species is the extent to which habitat is altered by the various activities and thus the influence on the persistence of a species at a known site, and the extent to which project design features would provide for persistence at a site.

Across the project area, none of the activities proposed for this project would remove the primary substrate for LOOR. Two of the three known sites are associated with fuel treatment units in which the existing canopy cover and associated canopy crown shading would be maintained. The targeted material for removal includes shrub vegetation and suppressed saplings; thereby, retaining sub-canopy trees for potential dispersal sites. The primary activity in the TSI unit is removing of small diameter conifers and post-activity fuels treatment.

To reduce the effects of burning (i.e. heat stress and atmospheric changes) relative to the shaded fuelbreaks, no pile burning would occur beneath the canopy of the occupied tree or canopies of late-mature trees in FB-Unit 13B. In the TSI Unit 87, a no disturbance buffer has been established around the occupied tree to maintain existing canopy shade and to reduce effects associated with burning.

With the project design features in place, the project provides for persistence of *Lobaria oregana* at each site.

Relative to USLO, none of the activities would remove the occupied substrate for USLO. In addition, a buffer has been established in Unit 78 to maintain the trees in the sub-canopy of the mature Douglas-fir trees—sites for potential dispersal.

To reduce the effects of burning (i.e. heat stress and atmospheric changes) no pile burning or understory burning would occur in the buffer of Unit 78. USLO in Unit 81, a Jeffrey pine restoration unit, occupies a Jeffrey pine tree isolated in the middle of a grassland. Prescribed burning is the only activity that may affect USLO. To reduce burning beneath the tree, needle litter and woody debris if any, will be raked away from the base of the tree.

With the project design features in place, the project provides for persistence of USLO at each site.

Invasive Plant Species

The following invasive plant species have been documented in association with this project: meadow knapweed (*Centaurea pratensis*), english ivy (*Hedera helix*), tansy ragwort (*Senecio jacobeae*), scotch broom (*Cytisus scoparius*), and french broom (*Genista monspellusana*). The first 3-5 mile length of French Hill Route 411 from CA 199, supports, all species either along the roadside, at landings or along temporary roads. Details on the location, specifically units involved, road number and UTMS in NAD 83 are provided in the Invasive Plant Risk Assessment for this project (Hoover 2014b).

Broom species and meadow knapweed are relatively shade intolerant; therefore, habitat vulnerability is based upon existing shade as well as the extent of competing native vegetation cover. Other variables include the extent of previous disturbance and resultant reduction in canopy shade. Open habitats including sparsely vegetated shrublands, grasslands, areas of ground disturbance due to past logging, road construction and road maintenance, and private land developments are considered to be high risk settings.

Compared to the aforementioned species, tansy ragwort has a wide ecological niche, occurring in open pasture lands, roadsides but also under moderate canopy. English ivy is very shade intolerant and currently very isolated in the project area to CT- Unit 1.

Roads are a primary vector for the introduction and spread of weeds (Gelbard and Harrison 2003). Scotch broom seeds undergo ballistic dispersal (Bossard 2000) when the seed pods burst open; therefore, these seeds can land on road edges and as they mature and continue migration down the road in this manner. Invasive plant seed and seed heads are readily picked up by equipment and thus readily transported to non-infested sites.

The project activities that have the highest risk of introduction and spread of any of these species are as follows:

1) landing development due to the presence of invasive plants coinciding with at least 5 of the existing landings, the complete clearing of vegetation associated with landing reconstruction and construction of 12 new landings and the concentrated use of equipment at landings,

2) ground-based thinning in CT- Unit 1 due to the presence of English ivy on the ground and around the tree trunks in this unit, the ability of ivy to reproduce via stem fragmentation, and the ease with which ivy can be picked up on machinery and transported elsewhere.

3) new temporary road construction and existing road reconstruction due to the ground disturbance, clearing of existing competing vegetation,

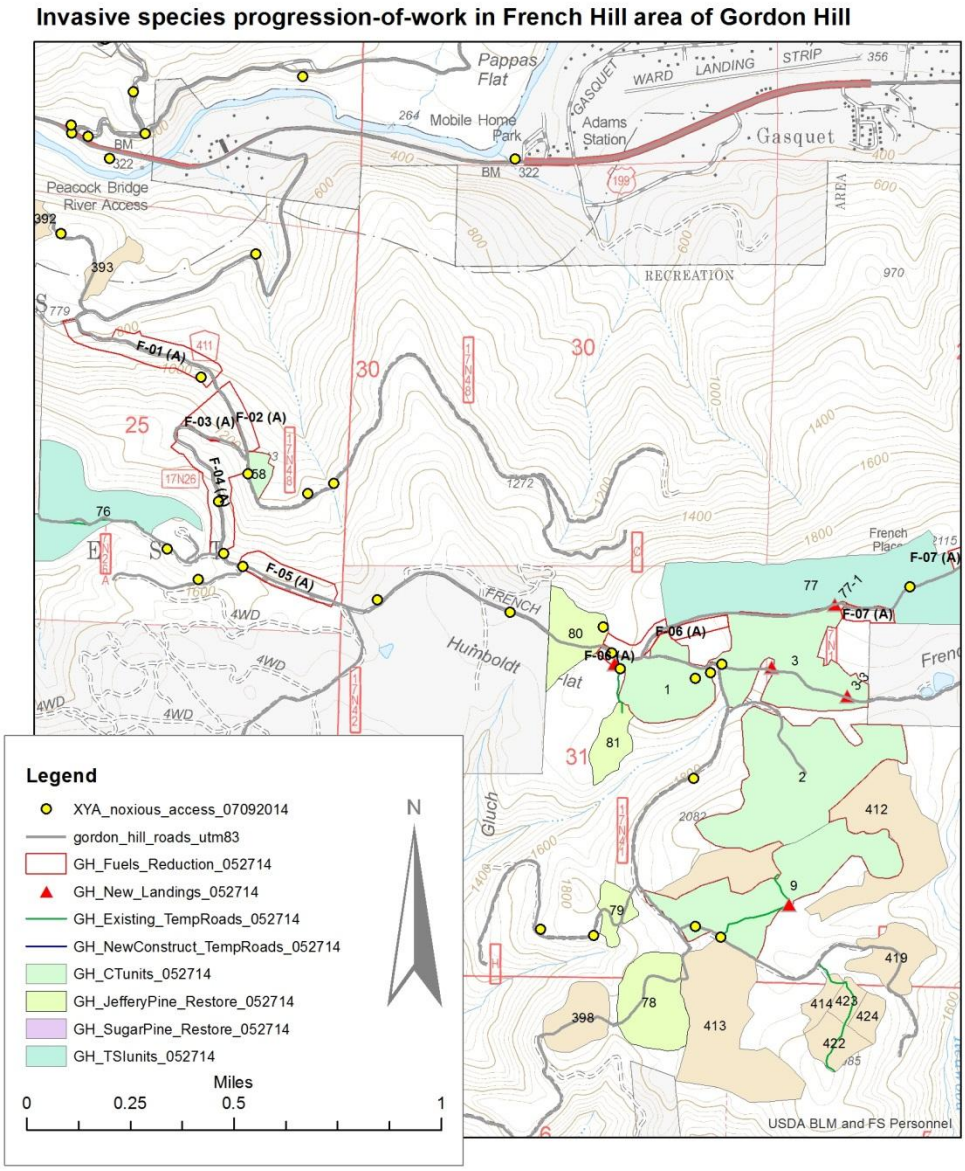
3) fuel reduction implementation in early mature and younger stands or shrublands due to vulnerability of road edges relative to invasive plant establishment, in association with the ease of plant spread beyond the road edge as a result of clearing of understory vegetation and subsequent pile burning or understory burning.

4) Jeffrey pine restoration due to the open setting, presence of invasive plant sites on the edge of or proximal to the grassland and the proposed prescribed burning which can enhance conditions for invasive plant spread.

For high risk activities, project design features are required to reduce the risk of introduction and spread. General practices related to equipment cleaning, use of weed-free source of material, mulching landings are included in Appendix E of this document and apply to this project. Site specific design features are detailed in the Invasive Plant Risk Assessment (Hoover 2014b) and in the Project Design Feature section of the document. Features include:

- Progression-of-work (time treatment to the end) is proposed for five commercial thin or timber stand improvement treatment units on French Hill Route 411 west of intersection with FS route 17N41 due to the array of invasive plant species associated with the area incorporating these units and the vulnerability of spread due to temp road development/redevelopment, landing development, private property proximity and non-project vectors associated with proximity to heavily used CA Highway 199 (Figure 4).

Figure 4. Progression of Work Area



- Equipment cleaning before operating elsewhere relative to CT Unit 1as English ivy is widespread in the unit and the risk of spread by fragmentation is high.
- Manual treatment (hand pulling, use of weed wrench or pulaski to completely remove root) of scotch/French broom, tansy ragwort (FB02-A, 03-A, 04-A) or meadow knapweed (FB-04A) sites where detected in association with all fuelbreaks. Leave removed plants on site or pile burn.
- Manual treatment of scotch/French broom or tansy ragwort at landings. Site prep (rip/sub-soil) landing and spread masticated material or mulch to a depth of 3-5" after operations on landing. Pile and burn residual broom as needed.
- Relocating landing 24-1 which currently overlaps with one of the two meadow knapweed sites in the project area. Do not disturb ground within flagged buffer area. Avoid ground disturbance in the immediate vicinity of this site. After use of landing associated with CT Unit 24, spread masticated material or mulch to a depth of 3-5" after operations.
- Mechanically treating tansy ragwort associated with the first ¼ mile of road leading to TSI Unit 76. Blade to clear plants from road prism. After use spread masticated material or mulch to a depth of 3-5" after operations on landing.
- Mulch the first 10-15 feet of new or existing temp road with chipped material or other native mulch at the intersection of the temp and system road after decommissioning.

No Action Alternative

The no action alternative would not create sites for invasive plant establishment, specifically there would be no new ground disturbance or clearing of existing vegetation for landings or temporary roads. Weed seed import on equipment or on foreign material used in the course of project implementation would not be an issue.

While issues pertaining to new ground disturbance, vegetation removal, and heavy equipment vectors for seed import are eliminated under the no action alternative, unmanaged, it is likely that weeds associated with road edges or openings (e.g. in the meadow), would continue to spread away from existing sites in association with routine road maintenance.

Proposed Action Alternative

The measure of effects due to the proposed action for invasive plant species is the extent of clearing and ground disturbance caused by the various activities, the extent to which mechanized equipment is used, and the extent to which project design features are expected to reduce or alleviate the effects of these activities. The relatively high risk activities have been addressed above as have the project design features to reduce the risk these activities pose to the introduction and spread of invasive plants.

Port-Orford-Cedar Root Disease Risk Assessment

A risk analysis of Port-Orford-cedar root disease *(Phytophthora lateralis)* is required under the Six Rivers LRMP for proposed projects that occur within watersheds containing Port-Orford-cedar (POC). A Risk Assessment and Disease Control Strategy Report specific to this project is included in this EA as Appendix F.

The primary transportation routes on the north and east of the project area are county roads 411 and 405, which have no access restrictions year round. There are already heavy POC disease infestations off all portions of these two county roads. All proposed treatment units were evaluated for the presence of POC in or adjacent to the unit. The project area contains POC, with the majority located within riparian zones. Portions of Craigs, Hurdygurdy, Gordon, and Cant Hook creeks, and Lower Fork Smith River within the project area contain infected stands of POC (refer to the map in Appendix F). Due to the proximity of POC to roads in the project area, the risk to further import, export, or spread the POC root disease is medium to high without POC root disease control prescriptions in place. The risk for this area could be reduced to low by the implementation of the prescriptions of the control strategy.

Mitigations measures, as described in the project design features in Chapter 2, were included during the design of the project. The mitigation measures used to protect POC will be applied to the project area as a whole, which is critical to successfully protecting POC. Requiring any vehicles or equipment be washed prior to entering the project area, limiting operations to the dry season, and requiring operation occur in uninfected areas before infected areas have all proven to be effective in preventing the spread of POC into new areas. In addition to these general mitigation measures, POC stands in units were primarily found within RR and were included in RR equipment exclusion buffers. Other units were dropped during the field review and planning stage due to POC concerns. The risk of spreading POC root disease through project implementation is low. In summary, with the design features in place there is a low risk of root disease spread and infection of uninfected areas associated with the proposed action.

Economic Analysis

This section presents the outcome of an economic analysis conducted for the Gordon Hill Vegetation and Fuels Management project from two perspectives: 1) economic viability relative to the product removal portion of the project, and 2) the financial efficiency of implementing all proposed activities, as required under Forest Service Handbook 2409.18 (USDA FS 2002).

Economic Viability

Commercial treatment units (CT units), in which conifers greater than 8 inches DBH

would be harvested and removed, were analyzed using the Timber Sale Economic Evaluation program (R5_SALE_EVAL V 3.0 – R5 – December 2008) to determine timber sale viability (i.e. whether or not a purchaser would bid on a timber sale) and potential harvest revenues. 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. The analysis for the Gordon Hill project assumes that all CT units 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 July 2014. Approximately 95 to 97 percent of the 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 $454/MBF.

Costs. Key costs incorporated in the analysis include logging, hauling, new and existing temporary road construction and/or re-utilization and post-harvest decommissioning, purchaser road maintenance, purchaser road maintenance/surface replacement deposits, and purchaser BD deposits. Table 26 lists the volumes and key cost elements used in the Timber Sale Economic Evaluation program.

Table 45. Timber Sale Volume and Key Cost Elements

Value/Cost Element	Unit	Tractor	Cable
Acres	Acre	521	144
Estimated Net Volume	MBF	3,986	991
Logging	$/MBF	$167.34	$397.52
Haul	$/MBF	$50.28	$50.28
New & Existing Temporary Road Construction and/or Re-utilization & Post-harvest Decommissioning	$/MBF	$2.26	$9.38
Purchaser Road Maintenance	$/MBF	$10.38	$10.38
Purchaser Road Maintenance and Surface Replacement Deposit	$/MBF	$10.00	$10.00
Purchaser BD Deposit	$/MBF	$30.49	$25.29

Logging: Logging cost is based on rates established in the LogCost 14.0 – Stump to Truck Logging Appraisal program (January 2014). Logging costs include felling, whole-tree yarding, processing at landings and loading on trucks.

Haul: Haul cost is based rates established in the HaulCost 14.0 – Trucking Appraisal program (January 2014) using an average one-way haul distance of 55 miles to Brookings, Oregon (110 miles round trip), with an average of 5 MBF hauled per load.

Temporary Roads: Temporary road costs include the cost of constructing new temporary

roads, reopening/re-utilizing existing temporary roads, and decommissioning these roads once harvesting is completed. The average cost for constructing, reopening/re-utilizing and decommissioning temporary roads is $5,500/mile.

Purchaser 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.

Purchaser Road Maintenance and Surface Replacement Deposit: Road maintenance and surface replacement deposits paid to the Forest Service, by the purchaser, to cover the cost of deferred road maintenance and surface replacement work on FS system roads used for logging and hauling operations.

Purchaser BD Deposit: Purchaser BD is a deposit, paid by the purchaser to the Forest Service, to cover the costs associated with treatment of harvest generated slash. BD deposits are based on prescribed post-harvest activity fuel treatments. Whole tree yarding to landings, incorporated in the logging cost, would remove the bulk of harvest generated slash from commercial thinning units. BD Deposit costs include the handpiling and burning of any residual harvest generated slash in commercial thinning units, and burning of landing piles.

Alternative 1 (No Action)

No timber would be harvested, therefore no value would be realized or costs incurred under this alternative. Both the projected total value and total value at base rates would be $0.00. This alternative would not be financially attractive to potential bidders nor would it generate harvest revenues that could be applied to vegetation and fuel treatment work in non-commercial (TSI and F) units.

Alternative 2 (Proposed Action)

An estimated 3,987 MBF would be harvested under this alternative. When adjustments are made for costs associated with this alternative, competition, and profit and risk, the projected total timber value would be $473,038. The estimated total timber value at base rates would be $79,730. The value above base rates would be $393,308. This alternative would be economically viable under current market conditions and generate harvest revenues that could be applied to vegetation and fuel treatment work in non-commercial (TSI, F, and Jeffrey/Sugar Pine Restoration) units.

Financial Efficiency

Present net value (PNV) is a measure of financial 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 the estimated total harvest revenue, purchaser BD deposits, and purchaser road maintenance and surface replacement deposits presented above in the section on Economic Viability. Costs include Forest Service timber sale preparation and administration; hand cutting of vegetation in non-commercial (TSI, F, and Jeffrey/Sugar Pine Restoration) units; Forest Service fuel treatments in both commercial (CT) and non-commercial (TSI, F, and Jeffrey/Sugar Pine Restoration) units including: lop and scatter (L&S), mastication (MAS), hand piling (HP), burning hand piles (BP), and understory burning (UB); and Forest Service deferred road maintenance and surface replacement. Revenues and costs are expected to occur over a nine year period between 2014 and 2023. Table 46 lists the key revenue and cost elements used in the PNV analysis and the time period over which they are expected to occur.

Table 46. Present Net Value (PNV) Analysis – Key Revenue and Cost Elements

Revenue/Cost Element	Unit	Total Units	Revenue or (Cost) per Unit	Time Period
Sale Preparation	MBF	3987	($30.00)	2014
Sale Administration	MBF	3987	($15.40)	2015 – 2018
Harvest Revenues	MBF	3987	$118.65	2015 – 2018
BD Deposit	MBF	3987	$29.18	2015 – 2018
Road Maintenance/Surface Replacement Deposits	MBF	3987	$10.00	2015 – 2018
Hand Cutting Sub-merchantable Material	Acre	2036	($800.00)	2016 – 2020
Lop and Scatter	Acre	5	($350.00)	2016
Mastication	Acre	127	($1500.00)	2017
Hand Pile	Acre	1987	($641.43)	2016 – 2020
Burn Piles	Acre	1987	($350.00)	2018 – 2022
Understory Burn	Acre	980	($450.00)	2020 – 2023
Road Maintenance/Surface Replacement	MBF	3987	($10.00)	2022 - 2023

Alternative 1 (No Action)

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.

Alternative 2 (Proposed Action)

Under the proposed action alternative, approximately 2,748 acres of vegetation and fuel treatments would occur over the next 9 years. This alternative would rank second in terms of financial efficiency with a PNV of -$3,077,355. The opportunity cost associated with implementing this alternative would be $3,077,355.

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 benefits would be the acceleration of the development of late successional habitat characteristics in plantations and younger stands; restoration of ecological conditions in special habitats; and the reduction of fuel loading, and a lower risk of catastrophic fire, in forest stands within late successional reserves, northern spotted owl critical habitat, and adjacent to private property in the Gasquet and Big Flat communities.

Roads

Alternative 1, No Action

Under the no action alternative there will be no road maintenace activities performed on 21.84 miles of FS system roads specifically to access commercial units, no tempaory upgrade of 1.08 miles of OML 1 to OML 2 roads, no minor reconstruction of 2.8 miles of exisiting temporary roads, and no construction of 0.26 miles of new tempoary roads.

Alternative 2, Proposed Action

System roads within the planning boundary include 94.49 miles of National Forest Transportation System roads. Approximately 62.58 miles of FS system roads will be utilized for this project. Of these, approximately 21.84 miles of are needed to access commercial thin units and will require some form of maintenance over the life of the project. Road management maintenance levels are defined in Forest Service Handbook 7709.59, Section 62.32. The system roads needed for the project include Operational Maintenance Level (OML) 3 roads (11.01 miles), OML2 roads (9.7 miles) and OML1 (1.08 miles). OML 1 roads used for this project will be temporarily upgraded to OML 2 and returned to OML 1 status (closed to vehicle traffic) once the treatments has been completed.

Del Norte County roads needed to directly access the units identified in the project includes County Road 411 (French Hill Road) and County Road 405 (Big Flat Road). County Road 427 (South Fork Road) will be used when exiting the south project area (County Road 405) to get to State Highway 199. Landings along Del Norte County Road 411 are anticipated to encroach within the travel way in some areas and will require county permitting prior to commencement of work along this corridor.

The Smith River National Recreation Area Roads Analysis (RAP) and Off-Highway Vehicle Strategy (November 2005) recommended to keep, maintain, or store most of the roads identified in the project area. The Smith River NRA Restoration and Motorized Travel Management Project (RMTM) is currently under review with a decision pending. Under the RMTM, three roads needed to implement the Gordon Hill Project (17N07Q, 17N07R, and 17N16) are recommended for either decommissioning or downgrade to OML1 in the preferred alternative. The Gordon Hill Project will not change the recommendations for these roads; however, the road closures will be delayed until after the Gordon Hill Project treatments are completed.

The following 3 tables identify system roads within the planning area that may be used for this project:

Table 47. Maintenance Level 1 Roads

ID	Length Miles
15N11A	0.6
17N40D	0.18
17N41A	0.3

Table 48. Maintenance Level 2 Roads

ID	Length Miles		ID	Length Miles
15N11	2.7		17N07K	0.8
16N15	0.8		17N07Q	0.22
16N15A	0.17		17N07R	0.44
16N19	8.282		17N13	0.7
16N19E	0.95		17N14	0.39
16N19F	0.76		17N16	0.65
16N21	3.689		17N26	0.25
16N21F	1.8		17N37	0.14
16N36	1.2		17N40	1
16N37	1.2		17N40B	0.53
16N37B	0.17		17N40C	0.51
16N38	1.6		17N41	1.6
16N41	1.43		17N41G	0.95
16N41A	0.17		17N41H	0.9
16N41C	0.89		17N46	1.2
17N07G	1.67		17N48	1.66
17N07J	1.5		17N71	0.2

Table 49. Maintenance Level 3 Roads

ID	Length Miles	ID	Length Miles
17N04	7.89	17N07	10.39

The project will also require 0.26 miles of new constructed temporary roads within the planning area identified in the following table:

Table 50. New Constructed Temp Roads

ID	Purpose	Length Miles
1	facilitates cable logging unit 47c	0.09
2	facilitates cable logging unit 15b	0.08
3	accesses unit 91	0.10

The project will also use 2.8 miles of existing temporary roads, listed in the following table. These roads require re-opening and blading prior to use. Road reconstruction, as defined by Forest Service Manual 7700, would not be required.

Table 51. Existing Temporary Road Alignments by Unit

Temp Road ID	Miles
Unit 10 (10-1)	0.71
Unit 10 (10-2)	0.14
Unit 10 (10-3)	0.14
Unit 10 (10-4)	0.30
Unit 10 (428-1)	0.12
Unit 9 (9-1)	0.20
Unit 9 (9-2)	0.09
Unit 22a (16-1)	0.19
Unit 45 (45-3)	0.04
Unit 45 (45-1)	0.05
Unit 52 (52-1)	0.02
Unit 57 (57-1)	0.04
Unit 1 (81-2)	0.13
Unit 89 (89-1)	0.08
Unit 243 (243-1)	0.27
Unit 241 (246-1)	0.25

Heritage Resources

Cultural resources have been considered in all aspects of the Gordon Hill Vegetation and Fuels Management project. The proposed project was designed to ensure compliance with federal historic preservation laws while using management strategies developed to balance resource protection and ecosystem health.

Regulatory Framework and Guiding Regulations

The National Environmental Policy Act (NEPA), in conjunction with the National Historic Preservation Act of 1966 (NHPA), as amended (16 U.S.C. 470), directs all

Federal agencies to take into account the effects of their undertakings on properties included in, or eligible for, the National Register of Historic Places. Archaeological inventories have been conducted in the past within the project area. Additional pedestrian surveys were conducted specifically for the Gordon Hill Vegetation and Fuel Management Project to identify, record, and assess potential effects on cultural resources. This analysis is in conformance with regulations of the National Historic Preservation Act (NHPA), 1966, as amended (P.L. 89-665); the National Environmental Policy Act of 1969 (P.L. 91-190), the Archeological and Historic Preservation Act of 1974 (P.L. 86-523), the Archaeological Resources Protection Act (ARPA) of 1979 (P.L. 96-95), the Native American Grave Protection and Repatriation Act (NAGPRA) of 1990 (P.L. 101-601), and as called for by the *2013 Programmatic Agreement Among The U.S.D.A. Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, And the Advisory Council On Historic Preservation Regarding The Processes For Compliance With Section 106 Of The National Historic Preservation Act For Management of Historic Properties by the National Forests of the Pacific Southwest.* The Forest has met the requirements of Section 106 of the National Historic Preservation Act for this project following the procedures developed in Appendix H of the Regional Programmatic Agreement, *Region 5 Hazardous Fuels Protocol for Non-intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects*.

Existing Environment

Previous and current surveys have documented a total of thirty-five archaeological sites within the project vicinity. These sites primarily are associated with the area's mining history. Mineral commodities such as gold, chromite, and copper have been mined extensively since the mid-nineteenth century, often depending on economic demand associated with wartime efforts. Mining activity spiked during the Civil War, World Wars I & II, and the Korean War. This boom and bust trend often resulted in a cycle of older claims being periodically reopened and closed, creating extensive archaeological sites associated with many periods of actvity and reuse.

Of the thirty-five sites in the larger project boundary, twenty-two sites are within treatment units. All of the sites in the treatment units are historic, and are associated with mining in some shape or form. Resources include terrestrial and subsurface hard rock mining features, tailings, water conveyance systems, mining camps, domestic activity areas, and trails used to access the mines.

With the application of the design features discussed in Chapter 2, it is anticipated that the proposed activities will not adversely affect any of these cultural resources.

Current Condition

The environmental setting is a landscape shaped by past timber management, mining activities, land exchanges, recreational use, and wildfire. Many of the archaeological sites exhibit signs of past disturbance or damage, mainly due to the extensive logging history

of the area. A significant number of archaeological sites within the Gordon Hill project boundary have heavy fuel loads. These sites currently are at significant risk of experiencing damage in the event of a large wildfire.

Environmental Consequences

Alternative 1 (No Action)

None of the ground-disturbing or burning activities proposed for this project would take place. Therefore, this action would have no direct effect on cultural resources in the project area. Current conditions of cultural resources and traditional tribal land uses in the area would remain relatively unchanged.

Alternative 2 (Proposed Action)

It is anticipated that the implementation of this project will result in beneficial indirect and cumulative effects to archaeological sites by reducing fuel loads in and around sites. Treatments within archaeological sites primarily will include directional felling, bucking, and hand-carrying trees from archaeological sites. The purpose of these treatments is to reduce fuels on archaeological sites with the objective of achieving fuel loads conducive to low-intensity, short-duration ground fire within site boundaries in the event of a prescribed burn or wildfire.

Prescribed burning has the potential to damage archaeological sites directly and indirectly. Fire sensitive sites (e.g. wooden remains) are at the greatest threat from fire and can be completely consumed even at low intensities. Sites without flammable features are less vulnerable, but can be damaged when exposed to high intensity fire. Fire effects include, but are not limited to: cracking of architectural stones, spalling, sooting, and/or chemical changes to cultural materials. Under the proposed action with design features, fire sensitive sites would be protected from fire-related damage, using methods that include foaming wooden structures, constructing fire lines around structures, backfiring, and avoiding burning near sites if no other means of protection can be accomplished.

Connected activities that can damage cultural resources include using bulldozers or hand tools to construct fire line; road maintenance; digging out smoldering roots and stumps during mop-up; and cutting trees or snags. To protect sites from these types of activities, no ground-disturbing activities would be allowed within site boundaries.

Burning could indirectly create a higher susceptibility to erosion and vandalism if a substantial amount of plant cover is burned off from the archaeological sites. However, the overall impact to the archaeological sites from loss of plant cover would be minor and short-term because vegetation would be expected to regrow across the sites several months.

Commercial timber harvest will entail ground disturbance and, therefore, has the potential to affect cultural resources. Activities related to commercial timber harvest include mechanical tree cutting, harvesting operations, construction and the use of landings, and temporary road construction. Ground disturbance occurs when logs are dragged across the ground, skid trails are created, and logs are piled at landings. Ground-disturbing activities can cause the following effects on cultural resources, including:

compaction, movement, breakage, or the total destruction of artifacts, features, and site stratigraphy (subsurface cultural deposits). These effects can range in intensity and, in some instances, can lead to significant loss of data potential and diminishment of the characteristics that make historic properties eligible to the National Register of Historic Places. Additionally, heavy equipment used for timber harvesting operations can cause rutting and soil compaction, resulting in increased erosion, creating both direct and indirect effects on cultural resources. To protect sites from these types of effects, no ground-disturbing activities will be allowed within site boundaries.

Should additional archaeological sites or human remains be inadvertently discovered during project implementation, work in the immediate area will cease, and the Forest Heritage Program Manager will be contacted immediately to determine a course of action consistent with protocols set forth within the Regional Programmatic Agreement.

Cumulative Effects

For other projects in the Gordon Hill area, mitigation measures have been, and will continue to be, implemented to keep ground-disturbing activities out of site boundaries. Fuels reduction treatments have been, and will be, implemented to minimize fire effects on archaeological sites during prescribed burns. As such, the potential cumulative effects on cultural resources are not considered to be adverse.

Environmental Justice

Executive Order 12898 relating to Environmental Justice requires an assessment of whether minorities or low-income populations would be disproportionately affected. Potentially affected Native American Tribes were contacted about this Proposed Action and did not express any concerns. Although a high proportion of Native Americans and lower income people live in this portion of the State, this project would not affect them any differently than any other member of the public. Project design features associated with the project would protect heritage resource values.

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 EA. 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 North Coastal portion of California.

Chapter 4 - Consultation and Coordination

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:

Interdisciplinary Team Members:

David Palmer - District Ranger

Brenda Devlin/Sheila Balent - Team Leaders

Sheila Balent - Fuels Specialists

Mike McCain - Fisheries Biologist

Corrine Black – Hydrologist

Scott Hagerty/ Karla Knapek – Soils

Fred Levitan - Geologist

Jeff Jones - Silviculturist

Lisa Hoover-Botanist

Victor Dumlao – Transportation Engineer

Jennifer Dyer – Archeologist

Brenda Devlin-Wildlife Biologist

Lenore Crippa – Logging Systems Specialist

Shawn Smith – Forester/ GIS

Shirley Rech – Economics Analyst

Federal and State Agencies:

USDI Fish and Wildlife Service

California Regional Water Quality Control Board -- North Coast Region

National Marine Fisheries

Tribes:

Elk Valley Rancheria

Smith River Rancheria

Tolowa Nation

Other Parties:

American Forest Resource Council (AFRC)

Del Norte County Board of Supervisors

Del Norte County Fire Safe Council

Environmental Protection Information Center (EPIC)

Klamath Siskiyou Wildlands Center (KSW)

Conservation Congress

Smith River Alliance

Chapter 5 – References Cited

Adams, S. and Sawyer, J. 1980. Past fire incidence in mixed evergreen forests of northwest California. Report on file Six Rivers National Forest. 22 p.

Adams, H.D., M. Guardiola-Claramontea, G.A. Barron-Gafforda, J.C. Villegasa, D.D. Breshears, C.B. Zoug, P.A. Troucha, and T.E. Huxman. 2009. Temperature sensitivity of drought-induced tree mortality portends increased regional die-off under global-change-type drought. Proceedings of the National Academy of Sciences. 106: 7063-7066.

Agee, J. K., Bahro, B., Finney, M. A., Omi, P. N., Sapsis, D. B., Skinner, C. N., van Wagtendonk, J. W., and C. P. Weatherspoon. 2000. The use of shaded fuelbreaks in landscape fire management. For. Ecol. and Manage. 127: 55–66.
Agee, J.K. and C.N. Skinner. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management 211: 83–96.

Airola, D.A., ed. 1980. California Wildlife Habitat Relationship Program: Northeast Interior Zone. Vol. III. Birds. U.S. Dep. Agric., For. Serv., Lassen Natl. For. , Susanville. 509pp.

Alexander, Earl B and Roger Poff. 1985. Soil Disturbance and Compaction in Wildland Management. USDA Forest Service, Pacific Southwest Region, Watershed Staff. Earth Resources Monograph 8.

Amaranthus, M. P.; J. M. Trappe and R. J. Molina. 1989. Long-term forest productivity and the living soil. In: Maintaining the long-term productivity of Pacific northwest forest ecosystems. D. A. Perry, ed: 36 and 48.

Anderson, H.W. 1971. Relative contributions of sediment for source areas, and transport processes. Pages 55-63 in Krygier and Hall (1971).

Anderson, H. E. 1982. Aids to determining fuel models for estimating fire behavior. Gen. Tech. Rep. INT-122. Ogden UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experimental Station. 22p.

Andrews, P. L., Bevins, C. D., and R. C. Seli. 2005. BehavePlus fire modeling system, version 5.0: User's Guide. Gen. Tech. Rep. RMRS-GTR-106WWW Revised. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 144 pp.

Archie, M. A., and R. A. Hudson. 1973. Scattered mixed coniferous forest in subalpine meadows and spruce bogs. Pages 1002-1003 in W. T. Van Velzen, ed. Thirty-seventh breeding bird census. Am. Birds 27:955-1019

Atzet, T., and R.E. Martin. 1991. Natural Disturbance Regimes in the Klamath Province. *In:* Proceedings of the Symposium on Biodiversity of Northwestern California. October 28-30, 1991, Santa Rosa, CA.

Bailey, J.D., and J.C. Tappeiner. 1998. Effects of thinning on structural development in

40-100 year old Douglas-fir stands in western Oregon. For.Ecol. Manage. 108:99-113.

Baldwin, P. H., and W. F. Hunter. 1963. Nesting and nest visitors of the Vaux's swift in Montana. Auk 80:81-85.

Balent, S. 2014. Gordon Hill Vegetation and Fuels Management Project Fuels Specialist Report. Unpublished specialist report on file at Six Rivers National Forest.

Barrows, C. 1980. Feeding ecology of the spotted owl in California. Raptor Research Baldwin, P. H., and N. K. Zaczkowski. 1963. Breeding biology of the Vaux swift. Condor 65:400-406.

Beaver, D. L., and P. H. Baldwin. 1975. Ecological overlap and the problem of competition and sympatry in the western and Hammond's flycatchers. Condor 77:1-13.

Behler, J. L., and F. W. King. 1979. The Audubon Society field guide to North American reptiles and amphibians. Alfred Knopf, New York. 743pp.

Belt, G.H., J. O'Laughlin and T. Merrill. 1992. Design of forest riparian buffer strips for the protection of water quality: Analysis of scientific literature. Report Number 8, Idaho Forest, Wildlife and Range Policy Analysis Group. 35 p. Avail. College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho.

Bent, A. C. 1938 (book). Life histories of North American birds of prey. Part 2. U.S. National Museum Bulletin, no. 170.

Berg, L, and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (Oncorhynchus kisutch) following short-term pulses of suspended sediment. Can. J. Fish. Aquat. Sci., 42:1410-1417.

Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. 1987. Stream temperatures and aquatic habitat: fisheries and forestry interactions. In: Salo, E.O. and T.W. Cundy (Eds) Streamside Management: forestry and fishery interactions. University of Washington. Seattle. Contribution 57. p. 191-232

Bilby, R.E. and P.A. Bisson. 1998. Function and distribution of large woody debris. P. 324-346 in: River ecology and management: Lessons from the Pacific Coastal Ecoregion. Edited by R.J. Naiman and R.E. Bilby. Springer, New York.

Bilby, R.E., B.R. Franson, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Sci. 50:164-173.

Bisson, P.A., R.E. Bilby, M.D. Bryant, C.A. Dolloff, G. B. Grette, R.A. House, M.L. Murphy, K.V. Koski, and J.R. Sedell. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. Pages 143-190 in E.O. Salo and T.W. Cundy, editors. Streamside management: forestry and fishery interactions. Contribution No. 57. Institute of Forest Resources, University of Washington, Seattle.

Bingham, B.B., and B.R. Noon. 1997. The use of core areas in comprehensive mitigation strategies. (47k) Conservation Biology 12(1):241-243.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. American Fisheries Society Special Publication 19: 83-138.

Black, C. 2014**.** Gordon Hill Fuels and Vegetative Management Hydrology Report. Six Rivers National Forest. Unpublished specialist report on file at Six Rivers National Forest.

Black, S.H and C. Mazzacano. 2010. Mardon Skipper Coon Mountain burn site occupancy study and surveys of Low Divide sites. Report to the U.S. Forest Service, Oregon Zoo, and U.S. Fish and Wildlife Service. 21pp.

Blaha. R.J. and B.A. Cooper. 2011. Radar Surveys for Marbled Murrelets Along the Western Border of the Six Rivers National Forest, California Summer 2010-2011. Report on file. USDA Forest Service, Six Rivers National Forest, Eureka, CA. 45pp.

Bock, C. E., and J. F. Lynch. 1970. Breeding bird populations of burned and unburned conifer forests in the Sierra Nevada. Condor 72:182-189

Boerner, R.E., J. Huang, and S.C. Hart. 2009. Impacts of fire and fire surrogate treatments on forest soil properties: a meta-analytical approach. Ecological Applications. 19: 338-358.

Bond, M.L., D.E. Lee, R.B. Siegel and J.P. Ward, Jr. 2009. Habitat use and selection by California spotted owls in a postfire landscape. Journal of Wildlife Management 73:1116–1124.

Bradshaw, L. and E. McCormick, 2000. FireFamily Plus user's guide, version 2.0. Gen. Tech. Rep. RMRS-GTR-67WWW. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Bostwick, P, et.al, 2011. How Fuel Treatment Saved Homes from The 2011 Wallow Fire, 2011.

Bull, E.L., and Beckwith, R. C. 1993. Diet and foraging behavior of Vaux's Swifts in northeastern Oregon. Condor 95:1016-1023.

Bull, E. L., and E. C. Meslow. 1977. Habitat requirements of the pileated woodpecker in northeastern Oregon. J. For. 75:335-337.

Bury, R.B. 1968. The distribution of *Ascaphus truei* in California. Herpetologica 24:39 –46.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Staus review of west coast steelhead from Washington, Idaho, Oregon, and California. USDC NOAA Tech. Memo. NMFS-NWFSC-27, 261 p.

Buskirk, S. W. and L. F. Ruggiero. 1994. The American marten. Pages 7–37. *in* Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, editors. American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service General Technical Report RM-254. Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado, USA.

Busse, Matt D., Carol J. Shestak, Ken R. Hubbert, Eric E. Knapp, 2010. Soil Physical Properties Regulate Lethal Soil Heating during Burning of Woody Residues. Soil Science Society of America Journal 74:947-955

California Energy Commission (CEC). 2006. Inventory of California Greenhouse Gas and Sinks: 1990-2004. CED-600-2006-013-SF: 132p.

California Dept. of Fish and Game 1998. Black Bear Management Plan. CDFG, Wildlife Program Branch, Sacramento, CA. 32 p.

California Dept. of Fish and Game 1998. Report to the Fish and Game Commission: An Assessment of Mule and Black-tailed Derr Habitats and populations in California. Wildlife Program Branch, Sacramento, CA.

California Department of Fish and Game. 1963, 1972, and 1978. Stream survey reports for Hurdygurdy Creek for 1963, 1972, and 1978 (CDFG 1963, 1972, 1978). Unpublished reports on file at the Smith River National Recreation Area.

Cannings, Richard J. and Tony Angell. 2001. Western Screech-Owl (Megascops kennicottii), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/597

Carey, A.B., D.R. Thysell, and A. Brodie. 1999. The Forest Ecosystem Study: background, rationale, implementation, baseline conditions, and silvicultural assessment**.** USDA For. Serv. Gen. Tech. Rep. PNW-GTR-457. 129 p.

Carey, A.B., S.P. Horton, and B.L. Biswell. 1992. Northern spotted owls: influence of prey base and landscape character. Ecological Monographs 62(2):223–250

Carey, AB.1995 Sciurids in Pacific Northwest Managed and Old-Growth Forests. Ecological Applications, Vol. 5, No. 3 pp. 648-661

Carroll, C., W.J. Zielinski, and R.F. Noss. 1999. Using presence-absence data to build and test spatial habitat models for the fisher in the Klamath Region, U.S.A. Conservation Biology 13: 1344-1359.

Cayan, D.R., E.P Maurer, M.D. Dettinger, M Tyree, and K Hayhoe. 2008. Climate change scenarios for the California region. Climate Change. 87: 21-42.

Cederholm, C.J., and N.P. Peterson. 1985. The retention of coho salmon (Oncorhynchus kisutch) carcasses by organic debris in small streams. Can. J. Fish. Aquat. Sci. 42:1222-1225.

Cederholm, C.J., and M. Reid. 1987. Impact of forest management on coho salmon (Onchorhynchus kisutch) populations of the Clearwater River, Washington: A project summary. In Streamside Management: Forestry and Fishery Interactions; E. Salo and T. Cundy Eds. Proceedings of a Symposium held at University of Washington, 12-14 February 1986. Contribution no. 57, Institute of Forest Resources, Seattle, Washington. pp. 373-398.

Certini, G. 2005. Effects of fire on properties of forest soils: a review. Oecologia 143:1-10.

Chambers, J.C. and M. Pellant. 2008. Climate change impacts on Northwestern and Intermountain United States rangelands. Rangelands. 30: 29-33.

Clark, Darren A. 2007. Demography and Habitat Selection of Northern Spotted Owls in Post-fire Landscapes of Southwestern Oregon. Master's Thesis submitted to Oregon State University, Corvallis, Oregon. 201pp.

Copstead et al., 1998. Water/Road Interaction: Introduction to surface cross drains. Report 9877-1806, SDTDC. San Dimas, CA: U. S. Department of Agriculture, Forest Service, Technology and Development Program.

Craighead, J. J., and F. C. Craighead, Jr. 1956. Hawks, owls and wildlife. Stackpole Books, Harrisburg, PA. 443pp.

Cram, D., T. Baker, and J. Boren. 2006. Wildland fire effects in silviculturally treated vs. untreated stands of New Mexico and Arizona. Research Paper RMRS-RP-55. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 28 pp.

Cranford, J. A. 1977. Home range and habitat utilization by Neotoma fuscipes as determined by radiotelemetry. J. Mammal. 58:165-172.

Curtis, Robert O. 1997. The Role of Extended Rotations. In: Creating a Forestry for the 21st Century, Kathryn A. Kohm and Jerry F. Franklin, editors. Island Press, Washington

D.C., 475 p.

DeBano, L.F. 1991. The effect of fire on soil properties. *In*: Proceedings—Management and Productivity of Western Montane Forest Soils. Harvey, A. and L. Neuenschwander, compilers. Gen. Tech. Rep. INT-280. Ogden, UT: USDA Forest Service, Intermountain Research Station. pp. 151-155.

Del Norte Fire Safe Council. 2005. Del Norte Community Wildfire Protection Plan. Crescent City, CA. 162 pp.

Devlin-Craig, B. 2014. Biological Assessment/Biological Evaluation for Federally Threatened and Endangered and Forest Service Sensitive Species within the Gordon Hill Project Area July 22, 2014. On file at Six Rivers National Forest.

Devlin-Craig B. and T. Owens 2014. Management Indicator Species Review for the Gordon Hill Vegetation and Fuels Management Project, Smith River National Recreation Area Six Rivers National Forest July 21, 2014. On file at Six Rivers National Forest.

Devlin-Craig B. and T. Owens 2014a. Migratory Landbird Conservation Neotropical Migratory Bird Species Review Gordon Hill Vegetation and Fuels Management Project Smith River National Recreation Area Six Rivers National Forest July 21, 2014. On file at Six Rivers National Forest.

Dixon, Gary E. and Ralph Johnson. 2008. Klamath Mountains Variant Overview- Forest Vegetation Simulator. USDA Forest Service, Forest Management Service Center, Fort Collins, CO.

Doerr S.H., R.A. Shakesby, and R.P.D. Walsh. 2000. Soil water repellency: its causes, characteristics, and hydro-geomorphological significance. Earth-Sci. Rev. 51:33-65.

Dyrness, C.T. 1965. Soil surface disturbance following tractor and high-lead logging in the Oregon Cascades. J. For. 63:272-275. Cited in Cromack, et al. (1980) A comparison of harvesting methods and their impact on soils and environment in the Pacific northwest. In: Forest Soils and Land Use, Proc. Fifth North American For. Soils Conf., Aug. 6-9, 1978. C.T. Youngberg, Ed., Colorado State Univ., 1978. Dept. of Forest and Wood Sciences, Colorado St. Univ., Fort Collins, Colorado.

Dryness, C.T. 1976. Effects of wildfire on soil wettability in the high Cascades of Oregoron. Res. Pap. PNW-202. Portland, OR: USDA Forest Service Pacific Northwest Research Station. 18 pp.

Dugger, K.M., R.G. Anthony and L.S. Andrews. 2011. Transient dynamics of invasive competition: barred owls, spotted owls, habitat composition and the demons of competition present. Ecological Applications, 21(7), 2011, pp. 2459–2468

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The birder's handbook. Simon and Schuster, New York. 785pp.

Everest, F. H., R. L. Beschta, J.C. Scrivener, K. B. Koski, J. R. Sedell, and C.J. Cederholm. 1987. Fine sediment and salmonid production: a paradox. Pages 98-142 in Salo and Cundy (1987).

Everett, R.L., P.F. Hessburg, and T.R. Lillybridge. 1994. Emphasis areas as an alternative to buffer zones and reserved areas in the conservation of biodiversity and ecosystem processes. Proceedings, American Forests Scientific Workshop, Assessing forest health in the inland West, November 14-19, 1993.

Federal Register (FR VOL. 66 NO. 160 Friday, August 17, 2001) www.gpoaccess.gov/fr/index.html

Field, C.B, G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack and N.L. Miller. 1999. Confronting climate change in California: ecological impacts on the golden state. Cambridge, MA: Union of Concerned Scientists. 63p.

Finney, M.A. 2006. An overview of FlamMap fire modeling capabilities. Pages 213-220 in Andrews, P.L. and B.W. Butler (eds.), Fuels Management - How to Measure Success: Conference Proceedings, 28-30 March 2006; Portland, OR. Proceedings RMRS-P-41. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Fitch, H.S. 1947. Predation by owls in the Sierran foothills of California. Condor:49:137-151.

Flanagan, Sam A., Michael J. Furniss, Tyler S. Ledwith, Stan Thiesen, Michael A. Love, Kemset Moore, and Jill Ory. 1998. Methods for Inventory and Environmental Risk Assessment of Road Drainage Crossings. In: Water/Road Interaction Technology Series. San Dimas Technology and Development Center, U.S. Forest Service.

Foltz, R.B, and E. Maillard. 2003. Infiltration rates on abandoned road-stream crossings. Paper Number 035009. ASAE Annual International Meeting. Las Vegas, Nevada. 11p.

Forsman, E.D. 1975. A preliminary investigation of the spotted owl in Oregon. Thesis, Oregon State University, Corvallis. 145 pp.

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1–64.

Forsman, E.D., R.G. Anthony, E.C. Meslow and C.J. Zabel. 2004. Diets and foraging behavior of northern spotted owls in Oregon. Journal of Raptor Research 38:214–230.

Forsman, E.D., R.G. Anthony, K.M. Dugger, E.M. Glenn, A.B. Franklin, G.C. White, C.J. Schwarz, K.P. Burnham, D.R. Anderson, J.D. Nichols, J.E. Hines, J.B. Lint, R.J. Davis, S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, S.A. Gremel, D.R. Herter, J.M. Higley, R.B. Horn, J.A. Reid, J. Rockweit, J. Schaberl, T.J. Snetsinger and

S.G. Sovern. 2011 (book). Population demography of northern spotted owls: 1985–2008. Studies in Avian Biology. Cooper Ornithological Society.

Franklin, A.B., D. R. Anderson, R. J. Gutiérrez, and K. P. Burnham 2000. Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecological Monographs 70:539–590

Fuller, D.D. 1995. Emigration and stream residency of juvenile steelhead in Hurdygurdy Creek, California. M.S. Thesis. Humboldt State University, Arcata, California.

Furniss, M. J., T. D. Roelofs, and C. S. Yee. 1991. Road construction and maintenance. Pages 297-323 in W.R. Meehan (ed.), Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19.

Gaines, D. 1974a. A new look at the nesting riparian avifauna of the Sacramento Valley, California. West. Birds 5:61-80.

Garrett, K., and J. Dunn. 1981. Birds of southern California. Los Angeles Audubon Soc. 408pp.

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Technical Memo NMFS-NWFSC-66.

Gould, G. I., Jr. 1974. The status of the spotted owl in California. Calif. Dep. Fish and Game, Sacramento, Admin. Rep. No. 74-6. 36pp.
Graham, Russel T., et al. 1999. The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-463, August, 1999.

Graham, Russel T. et.al. 2004. Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-120, March, 2004.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. BioScience Vol. 41, No. 8, pp 540-551.

Grinnell, J., and A. H. Miller. 1944. The distribution of the birds of California. Pac. Coast Avifauna No. 27. 608pp.

Hagans, Danny K. and William E. Weaver. 1997. Assessment and Implementation Techniques for Controlling Road-Related Sediment Sources.

Hamer, T. E. 1988. Home range size of the Northern Barred Owl and Northern Spotted Owl in western Washington. M.Sc. thesis, Western Washington University, Bellingham, WA.

Hamer, T.E., S. K. Nelson. 1995. Characteristics of Marbled Murrelet Nest Trees and Nesting Stands. USDA Forest Service Gen. Tech. Rep. PSW-152

Hamer, T.E., E.D. Forsman and E.M Glenn. 2007. Home range attributes and habitat selection of barred owls and spotted owls in an area of sympatry. Condor 109:750–768.

Hansen, D.L., and M.J. Mazurek. 2010. Effects of forest thinning on northern spotted owls. Unpublished white paper.

Hanson, C. T., D. C. Odion, D. A. DellaSala, and W. L. Baker. 2009. Overestimation of fire risk in the Northern Spotted Owl Recovery Plan. Conservation Biology 23:1314–1319.

Harr, R.D., W.C. Harper, J.T. Krygier, and F.S. Hsieh. 1975. Changes in storm hydrographs
after roadbuilding and clearcutting in the Oregon Coast Range. Water Resources Research 11:436-444.

Harr, R.D., J. Rothacher, and R.L. Fredriksen. 1979. Changes in streamflow following timber
harvest in southwestern Oregon. USDA Forest Service Research Paper PNW-249. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Hauge, C.J., M.J. Furniss, and F.D. Euphrat. 1979. Soil erosion in California's Coast Forest
District. California Geology (June):120-129.

Healey, M.C. 1991. Life history of chinook salmon (Oncorhynchus tshwytscha). In: C. Groot and L. Margolis, editors. Pacific Salmon Life Histories. University of British Columbia Press, Vancouver

Healey, S.P., W. B. Cohen, T. A. Spies, M. Moeur, D. Pflugmacher, M. G.Whitley, and M. Lefsky. 2008. The Relative Impact of Harvest and Fire upon Landscape-Level Dynamics of Older Forests: Lessons from the Northwest Forest Plan. Ecosystems (2008) 11: 1106–1119

Hermann, Richard K.; Lavender, Denis P. 1990. Pseudotsuga menziesii (Kirb.) Franco Douglas-fir. In: Burns, Russell M.; Honkala, Barbara H., technical coordinators. Silvics of North America. Volume 1. Conifers. Agric.Handb.654. Washington, DC: U.S. Department of Agriculture, Forest Service: 527-540.

Herter, D. R., and L. L. Hicks. 2000. Barred Owl and Spotted Owl populations and habitat in the central Cascade Range of Washington. Journal of Raptor Research 34:279–286.

Hessburg, P. F., R. B. Salter, and K. M. James. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecology 22.1 (2007): 5-24.

Heyerdahl, E.K, A,G, McKenzie, L. D. Daniels, A. E. Hessl, J. S. Littell, and N. J. Mantua. 2008. Climate drivers of regionally synchronous fires in the inland Northwest (1651–1900). International Journal of Wildland Fire 2008, 17, 40–49

Hibbs, D.E., P. Giordano and S. Chan. 1992. Vegetation dynamics in managed coastal riparian areas. P. 39-41. In: 1992 Annual Report of the Adaptive Coastal Oregon Productivity Enhancement Program. Adaptive COPE Program, Hatfield Marine Science Center, Oregon State University, Newport.

Hicks, B.J., J.D. Hall, P.A. Bisson, and J.R. Sedell. 1991. Responses of salmonids to habitat changes. In Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats; W.R. Meehan, ed. Pgs. 297-324. American Fisheries Society Special Pub. 19. Bethesda, MD.

Hoover, L.D. 2014a. Final Biological Evaluation/Biological Assessment for Threatened, Endangered, Sensitive Plant and Fungi Species for the Gordon Hill Vegetation and Fuels Management Project, Smith River National Recreation Area, July 18, 2014. On file Six Rivers National Forest Supervisor's Office, Eureka, CA

Hoover, L.D and B. Devlin-Craig. 2014b. Final Gordon Hill Vegetation and Fuels Project, Survey and Manage Report. Smith River National Recreation Area, July 24, 2014. On file Six Rivers National Forest Supervisor's Office, Eureka, CA

Howell, T. R. 1952. Natural history and differentiation in the yellow-bellied sapsucker. Condor 54:237-282.

Huffmann, E.L., L.H. MacDonald, and J.D. Stednick. 2001. Strenth and persistence of fire-induced soil hydrophobicity under ponderosa and lodgepole pine, Colorado Frong Range. Hydrol. Process. 15: 2877-2892. 5

Hungerford, R.D., M.G. Harrington, W.H. Frandsen, K.C. Ryan, and G.J. Niehoff. 1991. Influence of fire on factors that affect site productivity. In: Proceedings – Management and productivity of western montane forest soils. USDA FS Gen. Tech. Rep. INT-280. p. 32-50.

Ingles, L. G. 1947. Ecology and life history of the California gray squirrel. Calif. Fish and Game 33:138-158.

Ingles, L. G. 1965. Mammals of the Pacific states. Stanford Univ. Press, Stanford, CA. 506pp.

Innes, R. J., D. H. Van Vuren, D. A. Kelt, M. L. Johnson, J.A. Wilson and P. A. Stine. 2007. Habitat Associations of Dusky-Footed Woodrats (Neotoma fuscipes) in Mixed-Conifer Forest of the Northern Sierra Nevada. Journal of Mammalogy, Vol. 88, No. 6 (Dec., 2007), pp. 1523-1531

Irwin, L. L., L. A. Clark, D. C. Rock, S. L. Rock. 2007. Modeling Foraging Habitat of California Spotted Owls. Journal of Wildlife Management 71(4):1183–1191; 2007)

Irwin, L. L., D. F. Rock, and S. C. Rock. 2012. Habitat Selection by Northern Spotted Owls in Mixed-Coniferous Forests. The Journal of Wildlife Management 76(1):200–213.

Jenkins, M.J, W. G. Page, E. G. Hebertson, M. E. Alexander. 2012. Fuels and fire behavior dynamics in bark beetle-attacked forests in Western North America and implications for fire management. Forest Ecology and Management 275 (2012) 23–34

Jennings, M. R. and M. P. Hayes. 1994. Amphibian and reptile species of special concern in California. California Department of Fish and Game. Rancho Cordova 255 pp.

Jimerson, T, E. McGee, D.W. Jones, R.J. Svilich, E. Hotalen, G. DeNitto, T. Laurent, J.D. Tenpas, M.E. Smith, K. Hefner-McClelland, and J. Mattison. 1996. A field guide to the tanoak and Douglas-fir plant associations in northwestern California. USDA Forest Service Pacific Southwest Region R5-ECOL-TP- 009.

Johnson, O.W., M.H. Ruckelshaus, W.S. Grant, F.W. Waknitz, A.M. Garrett, G.J. Bryant, K. Neely, and J.J. Hard. 1999. Status review of coastal cutthroat trout from Washington, Oregon, and California. USDC NOAA Tech. Memo. NMFS-NWFSC-37, 292 p.

Johnson, D.W. and P.S. Curtis. 2001. Effects of froeset management on soil C and N storage: meta analysis. Forest Ecology and Management. 140: 227-238.

Jones, J.A. and G.E. Grant. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon. Water Resources Research 32:959-974.

Kelly, E.G., E.D. Forsman, and R.G. Anthony. 2003. Are barred owls displacing spotted owls? Condor 105:45–53.

Kelleyhouse, D. G. 1975. Habitat utilization and ecology of the black bear in northern California. M.S. Thesis, Humboldt State Univ., Arcata. 60pp

Keane, R.E., K.C. Ryan, T.T. Veblen, and others. 2002. Cascading effects of fire exclusion in the Rocky Mountain ecosystems: a literature review. Gen. Tech. Rep.

RMRS-GTR-91. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 24 pp.

Kennedy, R.S.H. and M. C. Wimberley. 2009. Historical fire and vegetation dynamics in dry forests of the interior Pacific Northwest, USA, and relationships to Northern Spotted Owl (Strix occidentalis caurina) habitat conservation. USDA Forest Service Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 Forest Ecology and Management 258 (2009) 554–566

Klock, G.O. 1975. Impact of five post-fire salvage logging systems on soils and vegetation. J. Soil & Water Cons. Vol. 30(2):78-81.

Koch, J., J. Strange, and P.H. Williams. 2012 (book) Bumble bees of the western United States. US Forest Service; San Francisco, Calif., 2012.

Lacki, M.J. and M.D. Baker. 2007. Day Roosts of Female Fringed Myotis (Myotis thysanodes) in Xeric Forests of the Pacific Northwest. Journal of Mammalogy. Vol. 88(4). 967-973.

Latham, P. and J. Tappeiner. 2002. Response of old-growth conifers to reduction in stand density in western Oregon forests. Tree Physiology 22, 137-146

Latta, G., H. Temesgen, D. Adams, and T. Barrett. 2010. Analysis of potential impacts of climate change on forests of the United States Pacific Northwest. Forest Ecology and Management 259 (2010) 720–729

Laurent, T. 2007. Soil monitoring data from 1998 to 2006. Klamath National Forest. On file at Klamath National Forest, 1212 Fairlane Rd., Yreka, CA 96097. 6p.

Lawrence, L. de K. 1967. A comparative life-history study of four species of woodpeckers. Ornithol. Monogr. No. 5. 156pp.

Ledwith, Tyler S. 2003a. Road assessment and restoration planning in the South Fork Smith watershed of the Smith River basin – Final Report. Funded by California Department of Fish and Game SB 271 contract# P0010306.

Ledwith, Tyler S. 2003b. Road assessment and restoration planning in the Middle Fork Smith watershed of the Smith River basin – Final Report. Funded by California Department of Fish and Game SB 271 contract# P0010306.

Littell, J.S., D. McKenzie, D. L. Peterson, and A. L. Westerling. 2009. Climate and wildfire area burned in western U.S. ecoprovinces, 1916–2003. Ecological Applications, 19(4), 2009, pp. 1003–1021

Littell, J.S., E. E. O'Neil, D. McKenzie, J. A. Hicke, J. A. Lutz, R. A. Norheim, M. M. Elsner. 2010. Forest ecosystems, disturbance, and climatic change in Washington State, USA. Climatic Change (2010) 102:129–158

Livezey, K. 2007. Barred owl habitat and prey: a review and synthesis of the literature J. Raptor Res. 41(3):177–201

Lofroth, E. C., C. M. Raley, J. M. Higley, R. L. Truex, J. S. Yaeger, J. C. Lewis, P. J. Happe, L. L. Finley, R. H. Naney, L. J. Hale, A. L. Krause, S. A. Livingston, A. M. Myers, and R. N. Brown. 2010. Conservation of Fishers (Martes pennanti) in South-Central British Columbia, Western Washington, Western Oregon, and California–Volume I: Conservation Assessment. USDI Bureau of Land Management, Denver, Colorado, USA.

Long, James N. 1985. A Practical Approach to Density Management. The Forestry Chronicle, February, 1985, For. Chron. 61:23-2.

Longhurst, W. M., A. S. Leopold, and R. F. Dasmann. 1952. A survey of California deer herds, their ranges and management problems. Calif. Dept. Fish and Game Bull. No. 6. 136pp

Luce, C.H. 1997. Effectiveness of road ripping in restoring infiltration capacity of forest roads. Restoration Ecology 5 (3):265-270.

Manuwal, D. A. 1970. Notes on the territoriality of Hammond's flycatchers in western Montana. Condor 72:364-365.

Marlon, J.R. , P.J. Bartlein, D. G. Gavin, C.J. Long, R. S. Anderson, C. E. Briles, K. J. Brown, D. Colombaroli, D. J. Hallett, M. J. Power, E. A. Scharf, and M. K. Walsh. 2012. Long-term perspective on wildfires in the western USA. Published online February 14, 2012. www.pnas.org/cgi/doi/10.1073/pnas. 1112839109

Marshall, J. T., Jr. 1939. Territorial behavior of the flammulated screech owl. Condor. 41:71-78.

McCain, M.E. 1994. Habitat utilization by the 1987 and 1988 cohorts of Chinook salmon from emergence to outmigration in Hurdygurdy Creek, California. M.S. Thesis. Humboldt State University, Arcata, California.

McCain, M., B. Devlin-Craig, C. Black (editors). 1995. Smith river ecosystem analysis: basin and subbasin analyses, and late-successional reserve assessment, version 1.0 (McCain et al. 1995). USDA Forest Service, Six Rivers National Forest, Eureka, California, 213 pp.

McCaskie, G., P. De Benedictis, R. Erickson, and J. Morlan. 1988. Birds of northern California, an annotated field list. 2nd ed. Golden Gate Audubon Soc., Berkeley. Reprinted with suppl. 108pp.

Mccallum, D. Archibald. 1994. Flammulated Owl (Otus flammeolus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/093

McDade, M.H., F.J. Swanson, W.A. McKee [and others]. 1990. Source distances for coarse woody debris entering small stream in western Oregon and Washington. Canadian Journal of Forest Research 20:326-330.

McGarry, E.V. 1994. A quantitative analysis and description of the delivery and distribution of large woody debris in Cummins Creek, Oregon. Oregon State University, Corvallis Oregon. M.S. Thesis.

Meehan, W.R. and T.C. Bjornn. 1991. Salmonid distributions and life histories. American Fisheries Society Special Publication 19: 47-82.

Megahan, W.F. 1990. Erosion and site productivity in western-Montana forest ecosystems. In: Proceedings, Management and Productivity of Western-Montana Forest Soils. Gen. Tech. Rep. INT-280. Ogden, UT: USDA Forest Service, Intermountain Research Station. pp. 146-150.

Meyers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R. S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. USDC NOAA Tech. Memo. NMFS-NWFSC-35, 443 p.

Miles, S.R and C.B. Goudey. 1997. Ecological Subregions of California, Section and Subsection Descriptions. USDA Forest Service, Pacific Southwest Region, Vallejo, CA.

Miller, R.E.; McIver, J.D.; Howes, S.W.; and W.B. Gaeuman. 2010. Assessment of soil disturbance in forests of the Interior Columbia River Basin: a critique. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-811.

Miller, J.D., H. D. Safford, M. Crimmins, and A. E. Thode. 2009. Quantitative Evidence for Increasing Forest Fire Severity in the Sierra Nevada and Southern Cascade Mountains, California and Nevada, USA Ecosystems (2009) 12: 16–32

Miller, J.D., C. N. Skinner, H. D. Safford, E. E. Knapp, and C. M. Ramirez. 2012. Trends and causes of severity, size, and number of fires in northwestern California, USA. Ecological Applications, 22(1), 2012, pp. 184–203

Morfin et al., 1996. Predicting Effects of Climate, Soil, and Topography on Road Erosion with the WEPP Model. Presented at 1996 ASAE Annual International Meeting. St. Joseph, Missouri.

Murphy, M.L. 1995. Forestry impacts on freshwater habitat of anadromous salmonids in the Pacific Northwest and Alaska -- requirements for protection and restoration. NOAA Coastal Ocean Program Decision Analysis Series No. 7. NOAA Coastal Ocean Office, Silver Spring, MD. 156 pp.

Mussehl, T. W. 1960. Blue grouse production, movements, and populations in the Bridger Mountains, Montana. J. Wildl. Manage. 24:60-68.

Nash III, T. H. 1996. Lichen Biology. Cambridge University Press, Cambridge, UK. 303pp.

National Wildfire Coordinating Group (NWCG). Glossary of Wildland Fire Terminology. http://www.nwcg.gov/pms/glossary.

Nearing, M.A., Pruski, F.F., and O'Neal M.R. 2004. Expected climate change impacts on soil erosion rates: A review. Journal of Soil and Water Conservation. 59(1):43-50.

Neary, D.G., K.C. Ryan, and L.F. DeBano, eds. 2005. Wildland fire in ecosystems: effects of fire on soils and water. Gen. Tech. Rep. RMRS-GTR-42-vol.4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 250 p.

Neitro, W.A., R.W. Mannan, D. Taylor, and others. 1985. Snags. In: Brown, E.R. tech. Ed. Management of Wildlife and Fish habitats in Forests of Western Oregon and Washington. Part 1 – Chapter Narratives. R6 F&WL- 192-1985. Portland, OR. USDA Forest Service, Pacific Northwest Region:129-169

Nelson, S.K., H. Mark, S.L. Miller, and M.G. Raphael. 2006. Chapter 2: Marbled Murrelet Biology: Habitat Relations and Populations in Northwest Forest Plan – the First 10 Years (1994-2003): Status and Trends of Populations and Nesting Habitat for the Marbled Murrelet. USDA Forest Service – General Technical Report. (650) 9-302.

National Marine Fisheries Service (NMFS). 1996. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. NMFS Northwest Region Environmental and Technical Services Division Habitat Conservation Branch. Portland, Oregon.

NMFS 1997. Biological Opinion and Conference Opinion. Routine and Non-routine Road Maintenance and Flood Response Actions. NMFS Southwest Region, Arcata, California. SWR-Arcata,CA-1997/1302

NMFS. 2003. Biological Opinion. 10 Categories of Forest Service and Bureau of Land Management Programmatic Activities in Northwestern Oregon. NMFS Northwest Region, Portland, Oregon. NWR-2002/01254.

NMFS. 2004. Biological and Conference Opinion. USDA Forest Service and USDI Bureau of Land Management Land and/or Resource Management Plans in the Northwest Forest Plan Area. NMFS Northwest Region, Portland, Oregon. NWR-2003/01457

Norden, B., M. Fyberg, F. Gotmark, and B. Olausson. 2004. Relative importance of coarse and fine woody debris for the diversity of wood-inhabiting fungi in temperate broadleaf forests. Biological Conservation 117, pp. 1-10.

North, M. P., J. F. Franklin, A. B. Carey, E. D. Forsman and T. Hamer. 1999. Forest stand structure of the northern spotted owl's foraging habitat. Forest Science 45:520-527.

Oliver, Chadwick D. and Bruce C. Larson. 1990. Forest Stand Dynamics. McGraw-Hill, Inc. San Fransisco, CA. 467 p.

Omi, P. and Martinson, E. 2002. Final report to the Joint Fire Science Program Board on the effects of fuel treatment on wildfire severity. 36 p.

Page-Dumroese, D., A. Abbot, T. Rice. 2009. National Soil Disturbance Monitoring Protocol . Volume 1 and 2: Rapid Assessment, Supplementary methods, statistics, data storage. U.S. Department of Agriculture, Forest Service. 95p.

Page-Dumroese, D.S.,M. F. Jurgensen, A. Abbot, T. Rice, J. Tirocke, S. Farley, and S. DeHart. 2006. Monitoring changes in soil quality from post fire logging in the Inland Northwest. *In*: Andrews, P.L.; Butler, B.W., comps. Proceedings Fuels Management: How to Measure Success. RM-P-41. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 605-614.

Parks, G.P., E.L. Bull, R.O. Tinnin, J.F. Shepard, A.K. Blumton. 1999. Wildlife Use of Dwarf Mistletoe Brooms in Douglas-Fir in Northeast Oregon. Western Journal of Applied Forestry 14 (2). 5p

Perry, D. A., P. F. Hessburg, C. N. Skinner, T. A. Spies, S. L. Stephens, A. H. Taylor, J. F. Franklin, B. McComb, G. Riegel. 2011. The ecology of mixed severity fire regimes in Washington, Oregon, and Northern California. Forest Ecology and Management 262 (2011) 703–717

Pierson, E.D. and W. E. Rainey. 1998. Fringed Myotis, Myotis thysanodes in Terrestrial Mammal Species of Special Concern in California. pp. 54-58. Bolster, B.C. Ed.

Ralph, S.C., G.C. Poole, L.L. Conquest, R.J. Naiman. 1994. Stream channel morphology and woody debris in logged and unlogged basins of western Washington. Can. J. Fish. Aquat. Sci. 51:37-51.

Rao, S., W.P. Stephen, C. Kimoto and S.J. DeBano. 2011. The Status of the ‘Red-Listed’ Bombus occidentalis (Hymenoptera: Apiformes) in Northeastern Oregon. Northwest Science 85: 64-67.

Raphael, M. G., and M. White. 1984. Use of snags by cavity-nesting birds in the Sierra Nevada. Wild. Monogr. No. 86. 66pp.

Raphael, M. G., and M. White. 1978. Avian utilization of snags in a northern California coniferous forest. U.S. Dep. Agric., For. Serv., Reg. 5, San Francisco. Prog. Rep. 18pp.

Raymond, C. and D. Peterson. 2005. How did prefire treatments affect the biscuit fire? Fire Management Today. 65: 18-22.

Reeves, G.H., F.H. Everest, and J.D. Hall. 1987. Interactions between the redside shiner (Richardsonius balteatus) and the steelhead trout (Salmo gairdneri) in western Oregon: the influence of water temperature. Can. J. Fish. Aquat. Sci. 44:1603-1613.

Reeves, G.H., L.E. Benda, K.M. Burnett, [and others]. 1995. A disturbance-based approach to maintaining and restoring freshwater habitats of evolutionarily significant units of anadromous salmonids in the Pacific Northwest. American Fisheries Society Symposium 17:334-349.

Reid, L.M., and S. Hilton. 1998. Buffering the buffer. USDA Forest Service Gen. Tech. Rep. PSW-GTR-168. 10 pp.

Reineke, L.H. 1933. Perfecting a stand-density index for even-aged forests. Journal of Agricultural Research. 46(7): 627-638.

Reiser, D.W. and T.C. Bjornn. 1979. Habitat requirements of anadromous salmonids. In: Influence of forest and rangeland management on anadromous fish habitat in the western U.S. and Canada. Gen. Tech. Rept. PNW-96. USDS Forest Service.

Reynold, R.T., and B.D. Linkart. 1987. Fidelity to territory and mate in flammulated owls. P 234-238 in R.W. Nero, R.J. Knapton, and R.H. Hamre (eds). Biology and conservation of northern forest owls: Symposium proceedings. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. GTR-RM-142. 309 p.

Rhodes, J.J., D.A. McCullough, and F.A. Espinosa, Jr. 1994. A coarse screening process for potential application in ESA consultations. Columbia River Intertribal Fish Commission.Prepared under NMFS/BIA Inter-Agency Agreement 40ABNF3. December.

Rosenberg, D. K., and R.G. Anthony. 1992. Characteristics of northern flying squirrel populations in young second- and old-growth forests in western Oregon. Canadian Journal of Zoology 70:161–166.

Rosenberg, D. K., C. J. Zabel, B. R. Noon, and E. C. Meslow. 1994. Northern spotted owls: influence of prey base a comment. Ecology, 75(5), 1994, pp. 1512-1515

Rosgen, D.L. 1994. A classification of natural rivers. Catena, vol. 22: 169-199. Elsevier Science, B.V. Amsterdam.

Ross, R. C. 1933. Western bluebird nesting in wall tile. Condor 35:73-74.

Rothermel, R. June 1983. How to predict the spread and intensity of forest and range fires. United States Forest Service, PMS 436-1; NFES 1573.

Sakai, H.F., and B.R. Noon. 1993. Dusky-footed woodrat abundance in different-aged forests in northwestern California. Journal of Wildlife Management 57:373–382.

Sakai, H. F., & B.R. Noon. 1997. Between-habitat movement of dusky-footed woodrats and vulnerability to predation. The Journal of wildlife management, 61(2): 343-350.

Sauer, J. R., J. E. Hines, and J. Fallon. 2001. The North American Breeding Bird Survey, Results and Analysis 1966 - 2000. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD

Sauer, J. R., J. E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 - 2007. Version 5.15.2008. USGS Patuxent Wildlife Research Center, Laurel, MD.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2012. Version 02.19.2014 USGS Patuxent Wildlife Research Center, Laurel, MD*

Scott, J. H. and R. E. Burgan. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

Sedell, J.R., and R.L. Beschta. 1991. Bringing back the "bio" in bioengineering. In Fisheries Bioengineering: Proceedings of a Symposium, Bethesda, MD; J. Colt and S. Dendall, eds. Pgs. 160-175. American Fisheries Society Publication 10. Bethesda, MD.

Shirazi, A.M. P.S. Muir, and B. McCune. 1996. Environmental factors influencing the distribution of the lichens Lobaria oregana and Lobaria pulmonaria. The Bryologist, Vol. 99 (1), pp. 12-18.

Siskiyou Research Group. 2004. Stony Creek, Diamond Creek, North Fork Diamond Creek, and Peridotite Canyon Level II stream surveys. Copy on file at USFS Smith River NRA fisheries office. Unpublished survey on file at the Smith River National Recreation Area.

Six Rivers National Forest. 1963 – 2008. Fish habitat inventories and fisheries surveys for Hurdygurdy, Jones, Goose, Patrick, Shelly, Siskiyou Fork, Myrtle, Hardscrabble, and Middle, South, and North Fork Smith.

Slauson, K. M., W. J. Zielinski, and J.P. Hayes. 2007. Habitat Selection by American Martens in Coastal California. Journal of Wildlife Management 71(2):458–468; 2007)

Slauson, K.M. and W.J. Zielinski. 2009. Characteristics of summer and fall diurnal resting habitat used by American martens in coastal northwestern California. Northwest Science 83(1):35–45.

Slauson, K.M., J.A. Baldwin, W.J. Zielinski, and T.A. Kirk. 2009b. Status and estimated size of the only remnant population of the Humboldt subspecies of the American marten (*Martes americana humboldtensis*) in northwestern California, Final report. Unpublished report 32 November 25, 2009. USDA FS, PSW, Redwood Sciences Laboratory, Arcata, California.

Smith, C. C. 1968. The adaptive nature of social organization in the genus of tree squirrels, *Tamiasciurus*. Ecol. Monogr. 38:31-63.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (Available from the National Marine Fisheries Service, Portland, Oregon). 356 p.

Spies, T.A., J.D. Miller, J.B. Buchanan, J.F. Lehmkuhl, J.F. Franklin, S.P. Healey, P.F. Hessburg, H.D. Safford, W.B. Cohen, R.S.H. Kennedy, E.E. Knapp, J.K. Agee and M. Moeur. 2010. Underestimating risks to the northern spotted owl in fire-prone forests: response to Hanson et al. Conservation Biology 24:330–333.

Solis, D.M. 1983. Summer habitat ecology of spotted owls in Northwestern California. Thesis, Humboldt State University, Arcata, California.

Solis, D.M., and R.J. Gutiérrez. 1990. Summer habitat ecology of northern spotted owls in northwestern California. Condor 92:739–748.

Stebbins, R. C. 1985. A field guide to western reptiles and amphibians. 2nd ed., revised. Houghton Mifflin, Boston. 336pp.

Sullivan, K., T.E. Lisle, C.A. Dolloff, G.E. Grant, and L.M. Reid. 1987. Stream channels: the link between forests and fishes. In Streamside Management: Forestry and Fishery Interactions; E.O. Salo and T.W. Cundy, eds. Pgs. 191-232. Contribution 57, University of Washington, Institute of Forest Resources. Seattle, WA.

Swanston, D.N. 1991. Natural processes. In Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats; W.R. Meehan, ed. Pgs. 139-179. American Fisheries Society Special Pub. 19. Bethesda, MD.

Syphard, A.D., R. M. Scheller, B. C. Ward, W. D. Spencer, and J. R. Strittholt. 2011. Simulating landscape-scale effects of fuels treatments in the Sierra Nevada, California, USA. International Journal of Wildland Fire 2011, 20, 364–383

Tappeiner, John C. II, Douglas A. Maguire, and Timothy B. Harrington, 2007. Silviculture and Ecology of Western U.S. Forests, Chap. 5 "Growth of Forest Trees and Stands". Oregon State University Press, Corvallis, OR, 440 p.

Taylor, Alan H. and Carl N. Skinner. 2003. Spatial Patterns and Controls on Historical Fire Regimes and Forest Structure in the Klamath Mountains. Ecological Applications, 13(3), 2003, pp. 704-719.

Thomas, J. W., ed. 1979. Wildlife habitats in managed forests: The Blue Mountains of Oregon and Washington. U.S. Dept. Agric., For. Serv., Portland, OR. Agric. Handb. No. 533. 512pp.

Thome, D. M., C. J. Zabel and L.V. Diller. 1999. Forest Stand Characteristics and Reproduction of Northern Spotted Owls in Managed North-Coastal California Forests. The Journal of Wildlife Management, Vol. 63, No. 1, pp. 44-59

Thompson, J., L. Diller, R. Golightly and R. Klug. 2007. Fisher (Martes pennanti) Use of a Managed Forest in Coastal Northwest California. USDA Forest Service General Technical Report PSW-GTR-194. 2pp.

Thorp, R. W., and M. D. Shepherd. 2005. Profile: Subgenus Bombus. In Shepherd, M. D., D. M. Vaughan, and S. H. Black (Eds). Red List of Pollinator Insects of North America. The Xerces Society for Invertebrate Conservation, Portland, OR.

Timossi, I. 1990. California statewide wildlife habitat relationships system. California Department of Fish and Game. Computer database for the IBM personal computer. June 1992 version.

USFS. 1976 through 1985. Fox Unit Monitoring Fishery Reports (USFS 1976 through 1985). Unpublished reports on file at the Smith River National Recreation Area.

USFS. 1979. Water Resources Inventory for USDA Forest Service Six Rivers National Forest, Eureka, California. Prepared by Ott Water Engineers, Redding, California under contract no. 53-9A47-9-28.

USDA-FS. 1990. Soil erosion hazard rating. Soil and Water Conservation Handbook, Ch. 50, R-5 FSH 2509.22, R5 Amend. 2. PSW Region, Vallejo, California

USDA Forest Service, Six Rivers National Forest. 1991. Hurdygurdy Creek fish habitat inventory (USFS 1991). Unpublished survey on file at the Smith River National Recreation Area.

USDA, 1992. Smith River National Recreation Area Management Plan. USDA Forest Service, Six Rivers National Forest. 61 pages

USDA Forest Service, Six Rivers National Forest. 1995. Six Rivers National Forest Land and Resource Management Plan (Six Rivers LRMP). Pacific Southwest Region. Vallejo, CA.

USDA Forest Service. 1995a. Forest Service Handbook, R-5 Supplement 2509.18-95-1. Region 5 Soil Quality Standards. Soil Management Handbook. San Francisco, CA. 10p.

USDA Forest Service. 1994. Soil Survey of Six Rivers National Forest Area, California, Parts of Del Norte, Humboldt, Siskiyou and Trinity Counties, California. USDA-Forest Service, Pacific SW Region, Vallejo, California.

USDA Forest Service 1995a. Smith River Ecosystem Analysis: Basin and Sub-basin analyses, and Late-Successional Reserve Assessment, version 1.0 (McCain, M., B. Devlin-Craig, C. Black, editors). Six Rivers National Forest, Eureka, California, 213 pp.

USDA-FS. 1995b. Soil quality monitoring. Forest Service Handbook 2509.18, R5 Supplement 2509.18-95-1, Chapter 2 (Effective 6/11/95).

USDA Forest Service. 1995a. Forest Service Handbook, R-5 Supplement 2509.18-95-1. Soil Management Handbook. San Francisco, CA. 10p.

USDA Forest Service. 1998. Six Rivers National Forest Wet Weather/Winter Operations Standards. Eureka, CA.

USDA Forest Service. 2002. Road-Stream Crossing Survey at Perennial Streams to assess Fish Passage on National Forest Lands. Six Rivers National Forest. Data is on file at the Supervisor's Office, Eureka, CA.

USDA Forest Service, Draft 2.4, 2000. Rating Watershed Condition: Reconnaissance Level Assessment for the National Forests of the Pacific Southwest Region. USDA Forest Service, Pacific Southwest Region.

USDA Forest Service 2000. Water Quality Management for Forest System Lands in California; Best Management Practices. USDA Forest Service, Pacific Southwest Region. 186 p.

U.S. Department of Agriculture, Forest Service. 2005. Preparing soil resource analyses for inclusion in NEPA documents. Pacific Southwest Region, USDA Forest Service. Vallejo, CA.

USDA Forest Service. 2013. Biological Assessment/Evaluation, Forest-wide Reference Document. Unpublished report. Original publication 1997, last update 9/12/2013. Six Rivers National Forest. 111 pp.

USDA-USDI Interagency Regional Ecosystem Office. 1996. Memorandum: Amendment to "Criteria to exempt specific silvicultural activities in Late Successional Reserves and managed Late Successional Reserves from Regional; Ecosystem office Review". Portland, OR. 6 pp.

USDA-USDI. 2001. Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire. Federal Register / Vol. 66, No. 160 / Friday, August 17, 2001

USDA Forest Service and USDI Bureau of Land Management. 2001b. Record of Decision for Amendment to the Survey and Mange, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Portland, OR

USFS. 1979. Water Resources Inventory for USDA Forest Service Six Rivers National Forest, Eureka, California. Prepared by Ott Water Engineers, Redding, California under contract no. 53-9A47-9-28.

USFS. 1976 through 1985. Fox Unit Monitoring Fishery Reports (USFS 1976 through 1985). Unpublished reports on file at the Smith River National Recreation Area.

USDI Fish and Wildlife Service 2009. Regulatory and Scientific Basis for U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region. Yreka, California 78 pp

U.S. Department of the Interior, Fish and Wildlife Service. 2011. Final Revised Recovery Plan for the Northern Spotted Owl, Strix occidentalis caurina. U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2011b. Endangered and Threated Wildlife and Plants: Designation of Revised Critical Habitat for the Marbled Murrelet: Final Rule. 50 CFR Part 17. Fed. Reg. 76(193) 61599-61621. October 5, 2011.

USDI Fish and Wildlife Service. 2011c. Species assessment and listing priority assessment form: Wolverine. 49 pp. April 2011.

USDI Fish and Wildlife Service. 2012. Revised critical habitat for the Northern spotted owl. Federal Register Volume 77, Number 233, Pages 71875-72068, FR Doc No: 2012-28714].

USDI. Fish and Wildlife Service. 2012b. Letter from Paul Henson (USFWS) Steve Homer (American Bird Conservancy) dated April 30, 2012, regarding the 2012 proposed critical habitat rule, climate change, and spotted owl recovery. U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2012c. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Mardon Skipper as Threatened or Endangered. 50 CFR Part 17. Fed Reg. 77 (171): 54332-54352. September 4, 2012.

Ward, J. P., JR. 1990. Spotted owl reproduction, diet and prey abundance in northwest California. M.S. Thesis, Humboldt State Univ., Arcata, Calif. 70pp.

Ward, J. P, Jr., R. J. Gutierrez, and B.R. Noon. 1998. Habitat selection by Northern Spotted Owls: the consequences of prey selection and distribution. Condor 100:79-92.

Waring R.H., N. C. Coops, S. W. Running, 2011. Predicting satellite-derived patterns of large scale disturbances in forests of the Pacific Northwest Region in response to recent climatic variation. Remote Sensing of Environment 115 (2011) 3554–3566

The Weather Channel. http://www.weather.com. July 9, 2013

Weins, J. A., and R. A. Nussbaum. 1975. Model estimation of energy flow in northwestern coniferous bird communities. Ecology 56:547-561.

Weisberg, Peter J. 2004. Importance of Non-Stand-Replacing Fire for Development of Forest Structure in the Pacific Northwest, USA. Forest Science 50(2) 2004.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. USDC NOAA Tech Memo. NMFS-NWFSC-24, 258 p.

Welke, Sylvia and James Fyles.2005. When texture matters: compaction in boreal forest soils. FSMN research note series. Available online at: http://www.sfmnetwork.ca/docs/e/RN_en_Compaction%20and%20Texture.pdf

Weller, T.J. and C.J. Zabel. 2001. Characteristics of Fringed Myotis Day Roosts in Northern California. The Journal of Wildlife Management. 65(3): 489-497.

Wells, C.G and J.R. Jorgensen. 1979. Effects of Intensive Harvesting on Nutrient Supply and Sustained Productivity. USDA Symposium Proceedings, 212-230. p 225-226

Welsh, H.H. Jr., and A.J. Lind. 1996. Habitat correlates of the southern torrent salamander, *Rhyacotriton variegatus* (Caudata: Rhyacotritonidae) in northwest California. Journal of Herpetology 30, p 385-398.

Wemple, B. 1994. Hydrologic integration of forest roads with stream networks in two basins, western Cascades, Oregon. MS Thesis. Oregon State University, Corvallis, OR.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. Ecological health of river basins in forested regions of eastern Oregon and Washington. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-326.

Williams, D. F., J. Verner, H. F. Sakai, and J. R. Waters. 1992. General biology of the major prey species of the California spotted owl.in J. Verner, editor. The California Spotted Owl: A Technical Assessment of Its Current Status. General Technical Report PSW-GTR-133 Pacific Southwest Research Station, Albany, California.

Williams, P. J. 2008. Home range and foraging habitat selection of spotted owls in the central Sierra Nevada. Master's thesis submitted to the University of Minnesota, Minneapolis, MN. 60 pp.

Williams, T.H., E. P. Bjorkstedt, W.G. Duffy, D. Hillemeier, G. Kautsky, T.E. Lisle, M. McCain, M. Rode, R.G. Szerlong, R.S. Schick, M.N. Goslin, and A. Agrawal. 2006. Historical population structure of coho salmon in the southern Oregon/northern California coasts evolutionarily significant unit. USDC NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-390. 71 p.

Wilson, R.A., P. Manley and B.R. Noon. 1990. Covariance patterns among birds and vegetation in a California oak woodland. In Proc., Symposium on oak woodlands and hardwood rangeland management (Davis, CA Oct. 31-Nov 2 1990). USDA For. Serv. Tech. Rep., PSW-126, p. 126-135.

Wilson, Duncan S. and Klaus J. Puettmann. 2007. Density management and biodiversity in young Douglas-fir forests: Challenges of managing across scales. Forest Ecology and Management 246 (2007) 123-134

Winter, J. 1974. The distribution of the flammulated owl in California. West. Birds. 5:25-44.

Wooldridge, D.D. 1960. Watershed disturbance from tractor and skyline crane logging. J. For. 58:369-372. Cited in Cromack, et al. (1980). A comparison of harvesting methods and their impact on soils and environment in the Pacific northwest. In: Forest Soils and Land Use, Proc. Fith North American For. Soils Conf., Aug. 6-9, 1978. C.T. Youngberg, Ed., Colorado State Univ., 1978. Dept. of Forest and Wood Sciences, Colorado St. Univ., Fort Collins, Colorado.

Zabel, C. J., K. McKelvey, and Ward, J .P. Jr. 1995. Influence of primary prey on home-ranges size and habitat-use patterns of Northern Spotted Owls (Strix occidentalis caurina). Can. J. Zool. 73:433-439.

Zabel, C.J., J. R. Dunk, H. B. Stauffer, L. M. Roberts, B. S. Mulder, and A. Wright. 2003. Northern spotted owl habitat models for research and management application in California (USA). Ecological Applications, 13(4), 2003, pp. 1027–1040

Zielinski, W. J., and R. T. Golightly. 1996. The status of marten in redwoods: is the Humboldt marten extinct? Pp. 115-119 in Conference on Coast Redwood Forest Ecology and Management (J. LeBlanc, ed.). Humboldt State University, Arcata, California.

Zielinski, W.J., K.M. Slauson, C.R. Carroll, C. J. Kent, D. G Kudrna. 2001. Status of American martens in coastal forests of the Pacific states. Journal of Mammalogy; May 2001; 82, 2; pg. 478

Ziemer, R.R. 1981. Storm flow response to road building and partial cutting in small streams of northern California. Water Resources Research 17(4):907-917.

Zeiner, D.C., W.F. Laudenslayer Jr., K.E. Mayer, and M. White. 1990. California statewide wildlife habitat relationships system. California's wildlife, 3 volumes. Calif. Dept. Fish and Game, Sacramento, CA.

Zeiner, D.C., W. Laundenslayer, Jr. K. Mayer, and M. White, eds. 1990. California's Wildlife, Vol. 2 Birds. California Department of Fish and Game. Sacramento. 732 pp.

Appendix A: Proposed Action Maps

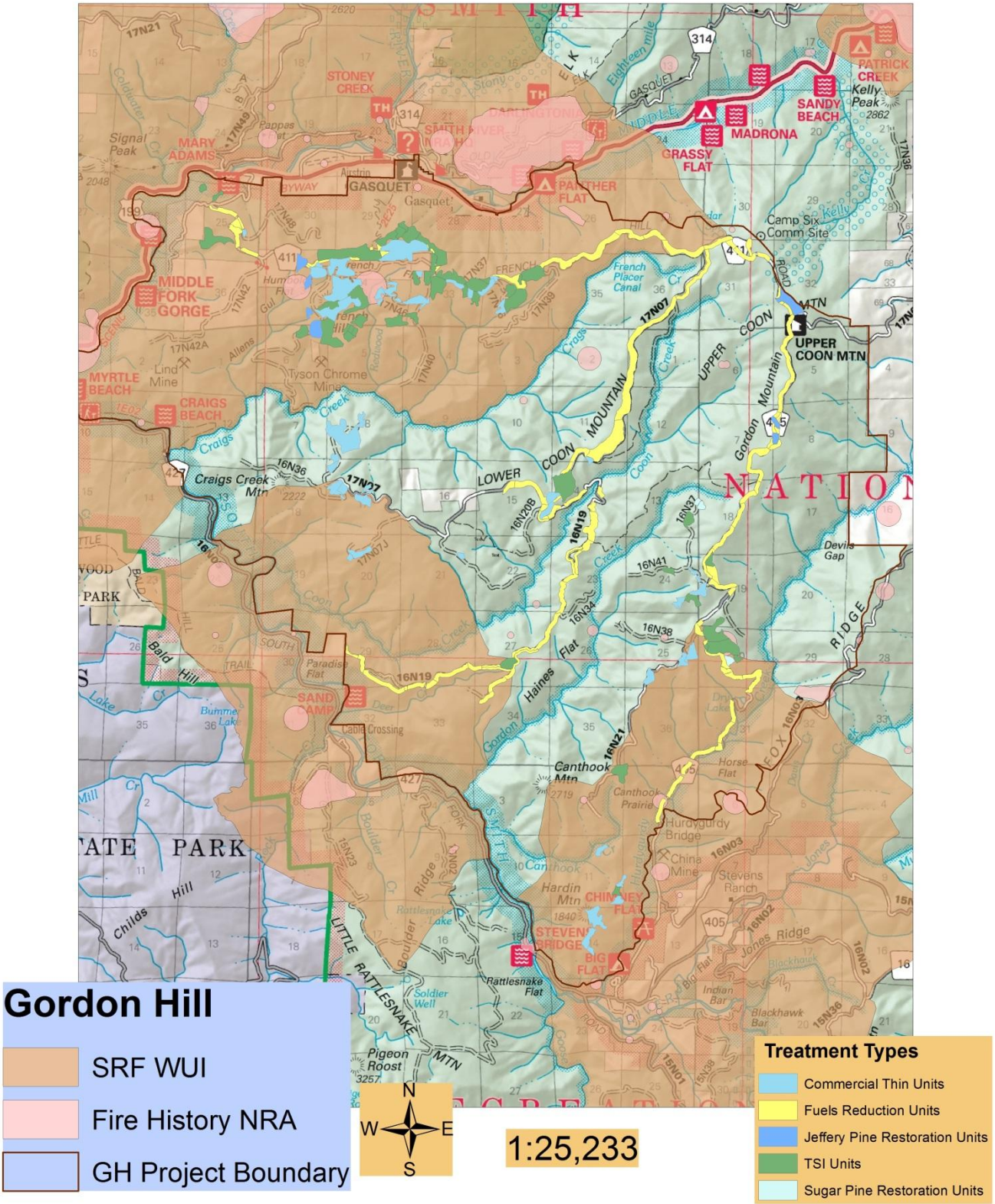
Alternative 2 – Proposed Action (All Treatments)

Alternative 2 –Proposed Action (Commerial Thinning & TSI by Units)

Alternative 2 –Proposed Action (Fuels, Sugar Pine, & Jeffery Pine by Units)

Appendix B Wildland/Urban interface Map

Gordon Hill Project WUI Map


Gordon Hill
SRF WUI
Fire History NRA
GH Project Boundary
Treatment Types
Commercial Thin Units
Fuels Reduction Units
Jeffery Pine Restoration Units
TSI Units
Sugar Pine Restoration Units
N
W
E
S
1:25,233
GASQUET
STONEY CREEK
MARY ADAMS
MIDDLE FORK GORGE
MYRTLE BEACH
CRAIGS BEACH
SAND CAMP
PANTHER FLAT
GRASSY FLAT
MADRONA
SANDY BEACH
PATRICK CREEK
STEVENS BRIDGE
CHIMNEY FLAT
BIG FLAT
UPPER COON MTN
LOWER COON MOUNTAIN
UPPER COON Mountain
Gordon Ridge
Craigs Creek Mtn
Canthook Mtn
Hardin Mtn
Pigeon Roost
LITTLE RATTLESNAKE MTN
Kelly Peak
Camp Six Comm Site
Devils Gap
Bald Hill
Childs Hill
Tyson Chrome Mine
Lind Mine
Paradise Flat
Cable Crossing
Rattlesnake Flat
Soldier Well
Hurdygurdy Bridge
China Mine
Stevens Ranch
Horse Flat
Canthook Prairie
Indian Bar
Blackhawk Bar
Jones Ridge
Bummer Lake
Signal Peak
Pappas Flat
Austrin
Gasquet
Eighteen mile
French Placer Canal
Haines Flat
Gordon Flat
Coon Creek
Craigs Creek
Kelly Creek
Redwood
Allens
Lake Cr
Mill Cr
Boulder Cr
Rattlesnake Lake
Big Flat
Blackhawk
Jones
Dry Lake
Deer
Tyson
Lind
Humbug Flat
French Hill
Stony
Pappas
Coldwater
Gul
Redwood
Boulder
Ridge
Canthook
Hurdygurdy
Horse
Devils
Gordon
Haines
Flat
Coon
Craigs
Kelly
Eighteen mile
Gasquet
Middle
Elk
Smith River
Darlingtonia
Old Gasquet
Gasquet Road
Scenic
Byway
Road
Hill
Trail
South
Bald
Hill
Lake
Cr
Mill
Cr
Childs
Hill
Boulder
Ridge
Rattlesnake
Lake
Soldier
Well
Pigeon
Roost
Big
Flat
Blackhawk
Jones
Ridge
Indian
Bar
Blackhawk
Bar
Devils
Gap
Horse
Flat
Canthook
Prairie
Hurdygurdy
Bridge
China
Mine
Stevens
Ranch
Hardin
Mtn
Canthook
Mtn
Craigs
Creek
Mtn
Tyson
Chrome
Mine
Lind
Mine
Paradise
Flat
Cable
Crossing
Bummer
Lake
Signal
Peak
Pappas
Flat
Austrin
Gasquet
Eighteen mile
French
Placer
Canal
Camp Six
Comm Site
Kelly
Peak
2862
UPPER
COON
MTN
UPPER
COON
Mountain
LOWER
COON
MOUNTAIN
Gordon
Ridge
Haines
Flat
Gordon
Flat
Coon
Creek
Craigs
Creek
Kelly
Creek
Redwood
Allens
Lake
Cr
Mill
Cr
Boulder
Cr
Rattlesnake
Lake
Big
Flat
Blackhawk
Jones
Ridge
Dry
Lake
Deer
Tyson
Lind
Humbug
Flat
French

Appendix C: Disposition of Scoping Comments

Issue Category	Comment	Commenter	Response to Comment
Vegetation Management	Request to display the desired levels of trees per acre by size class, desired stocking levels, desired snag and down log levels, and desired species makeup.	AFRC	This information can be found in the Silvicultural Report for the project.
Vegetation Management	The plantation treatments should be aggressive enough in order to maintain effectiveness for at least 30 -40 years.	AFRC	The prescriptions have been written to meet project purpose and need for habitat restoration.
Vegetation Management	The NEPA analysis needs to state whether the proposed action will meet the desired long term stand objectives.	AFRC	This information can be found in the EA on pgs.56-70.
Vegetation Management	We ask for an alternative to be analyzed that would require no more than two entries, including this one, to meet your long term stand characteristics.	AFRC	The purpose and need for the project is to maintain and improve wildlife habitat conditions. The prescriptions have been written to meet the purpose and need. The treatments as designed would result in minimum recommended stand stocking densities while still meeting the objectives of the LRMP for the LSR. Site-specific analysis will be required in the future (20 to 30 years) to determine what, if any, additional treatments would be required. The prescription as proposed will protect existing habitat characteristics, and would accelerate the development of important characteristics that are currently lacking. The project will meet S&Gs and objectives for LSR as described in the LRMP, and therefore will meet the purpose and need for the project.

Vegetation Management	In order to assist with determining long-term characteristics we ask that you review two documents. The first is *"Old Growth in Northwestern California National Forests"*, Beardsley, Debby and Ralph Warbington, Pacific Northwest Research Station, PNW-RP-491, June 1996. Note the number of large diameter trees found in the Douglas-fir/tanoak old growth forest type and snag and down log levels. It will take some intensive management in order to achieve results simulating historic old growth conditions. The second document is *"Stand Reconstruction and 200 Years of Forest Development on Selected Sites in the Upper South Umpqua Watershed"*, Dubrasich, Mike, Western Institute for Study of the Environment, November, 22, 2010. Even though this study is located within the Umpqua Watershed the stand characteristics and history are very similar to those found in the project area.	AFRC	The prescription as proposed will protect existing habitat characteristics, and would accelerate the development of important characteristics that are currently lacking. The project will meet S&Gs and objectives for LSR as described in the LRMP, and therefore will meet the purpose and need for the project. Please refer to the Silvicultural Report (Jones 2014) for a detailed explanation of the prescriptions.
Vegetation Management	The areas being treated outside the LSR should actually be treated even more aggressively.	AFRC	The purpose and need for the proposed action is to accelerate the development of late-successional habitat and provide forest products. Treatments outside LSRs also need to be consistent with the 2011 Recovery Plan for the northern spotted owl.
Vegetation Management	[In regards to Sugar Pine Restoration] A complete removal of all vegetation within the drip line of the retained sugar pine should be accomplished. There should be no thinning within the drip line.	AFRC	This is what was designed for the areas and is described in the Proposed Action (EA pg. 25)

Vegetation Management	It must be remembered the LSR network was not just set up to grow NSO habitat. It was designed to grow late-successional habitat that can be resilient and sustained on any given vegetative type and ecosystem. The intent of the Northwest Forest Plan was to grow long-term late-successional habitat based on land capability. Some of the area within the project area cannot be maintained as dense stands over the long-term, especially the sugar pine stands. They are not resilient and historically never contained those types of stand conditions. We ask that the analysis clearly display what type of late-successional habitat is sustainable for the long-term within this project area.	AFRC	This information can be found in the EA (pgs. 7, 44-57, and 136) as well as the Silvicultural Report (Jones 2014).
Vegetation Management	It will be very important to assess the feasibility of each logging system in relation to volumes per acre, size of trees being removed, distance to landing, species of tree being removed, current delivered log prices, etc. Since you have designated two systems as part of the proposed action we ask that you do an in-depth economic analysis in order to make sure your proposal is economically viable. Logging costs, fuel costs, and haul costs have all increased dramatically over the last few years while lumber prices have fallen. We ask that you take these recent increases and decreases into consideration in your economic analysis. We ask that you take these recent increases and decreases into consideration in your	AFRC	An economic analysis for the project has been completed and can be found on pg. 198 of the EA.

	economic analysis: Conventional harvesting – desire, as a minimum, to average 6-7 mbf/acre (more is needed if biomass removal is expected). Cable harvesting – desire, as a minimum, to average 10 mbf/acre. Also with skyline harvesting in order to pay for move in and move out costs the project should have a minimum of 1.5-2 mmbf. Species, yarding distance, haul distance, and size all play into the amount of volume needed to economically skyline harvest.		
Fuels	ARFC provided multiple comments expressing concern on the effectiveness of the proposed fuel break.	AFRC	After a field review with Forest Service fuels and vegetation management specialists, Mr. Svilich withdrew all his comments concerning the proposed fuels treatments.
Economics	It is important the project analysis complete an adequate assessment of all Social and Economic issues and concerns. Due to the economic conditions within Del Norte County it is imperative that social and economic issues be seriously considered when developing and selecting alternatives for implementation. If you look at Forest Service Manual, section 1920 Land Management Planning, there is a very important section that often plays second fiddle to all the resource issues on any given project. Given the number of pages dedicated to environmental issues, it is no wonder that our counties and communities do not fare well with Forest Service projects. I	AFRC	An economic analysis for the project has been completed and can be found on pg. 198 of the EA.

	have included the portion of the handbook that deals with specifics that we believe should be considered. Bottom line – the project needs to be economically viable! It needs to stand on its own without the need for supplemental funding.		
Riparian Reserves	Not treating riparian reserves does nothing in terms of providing resiliency for these important ecosystems.	AFRC	Treatments will occur in Riparian reserves (in the outer 80 ft. for commercial thinning and within 50ft for TSI and fuels reduction treatments) to improve habitat conditions within the RRs.
Limited Operating Periods	Limited operating periods (LOP's) can have significant negative impacts to implementing a proposed action. LOP's have serious implementation economic affects.	AFRC	Federal Agencies are required to minimize impacts to sensitive resources including Threatened, Endangered and Sensitive Species. Surveys have been conducted and LOPs applied in specific areas to prevent disturbance to TES species. Operating restrictions may also be imposed for other resources as needed to comply with LRMP S&G as well as with other laws and regulations.
Temporary Roads	We are very aware there will be undue pressure put on the decision maker to not develop any temporary roads for this project. We take the opposite view point It is important an adequate road system be developed and utilized in order to effectively and efficiently harvest the timber from this project. While decommissioning unneeded roads is understandable and supportable we also ask that serious consideration be made for including temporary road construction that will assist with the implementation of this project. We encourage the building of temporary spurs where feasible to reduce the harvest costs and more effectively treat the	AFRC	New temporary roads have been proposed as needed to meet the project objectives. Treatment units have been reviewed by FS specialists who have determined that the proposed infrastructure is adequate to efficiently and cost effectively treat the units and fuels.

	land base. If whole tree yarding/top yarding is proposed make sure landings can accommodate the merchantable and unmerchantable material. .		
Machine Piles	Do not be forced into dropping the option of machine piling. This technique has been used effectively for decades with no detrimental effects to the soils resource.	AFRC	Machine piling will allowed in areas that meet all LRMP S&Gs. LRMP Standard and Guidelines limit the use of tractors to slope with 35% or less slope.
Diameter limits	Diameter limits are arbitrary designations that do not have any silvicultural merit. They are counterproductive to meeting your identified purpose and need statements. AFRC does not and will not support diameter limits as they are not compatible with your current land management goals for this project area.	AFRC	Tree diameter limits are restricted to LSRs; however, the stands selected for treatment are younger, predominantly even-aged stands, and there are a very limited number of larger trees (20 inches DBH or greater) in these stands. Stands outside LSRs do not have a diameter limit, but the prescription does require maintaining the larger trees in the stands.
Fuels Treatments	The project should carefully look at fuels reduction options. Hand piling should be the last option as it is very expensive and can lead to a nonviable project. Do not be forced into dropping the option of machine piling. This technique has been used effectively for decades with no detrimental effects to the soils resource. Yarding tops and lopping and scattering should take care of most of the fuels issues within the treated stands.	AFRC	The purpose and need for the project includes fuels reduction for community protection. Fuels reduction treatments have been designed to meet the objectives of the project. Machine piling will allowed in areas that meet all LRMP S&Gs.
LSR S&Gs	We believe the Forest should pursue with REO the ability to harvest trees greater than 20 inches within the LSR if they are needed for removal in order to meet project objectives.	AFRC	The purpose and need for the proposed action is to accelerate the development of late-successional habitat. To that end, commercial thinning prescriptions were designed to maintain the largest and healthiest trees in the stand. The stands selected for treatment are younger,

			predominantly even-aged stands. The limited number of trees 20 inches DBH or greater in LSRs represent the largest trees in these stands. In addition, this project was designed under the HFRA authority, and an REO exemption is not possible using this authority.
Vegetation Management	When developing measurement standards for NEPA implementation do not use crown closure. The measurement standards need to be something that can be measured correctly before and following treatment; basal area, trees per acre, stand density index, spacing, etc.	AFRC	Canopy closure is a measure that the majority of the public understands. However, residual basal area (RBA) would be incorporated into marking guidelines as a proxy for canopy closure since RBA is easier to measure in the field.
Vegetation Management	We feel this project needs to treat as many acres as possible in order to fully meet your designated purpose and need. We encourage you not to reduce the project any further. The current industry infrastructure is very important in terms of implementing your projects. This needs to be a consideration when assessing economics and project design. As project size and volumes shrink during the NEPA analysis it may not individually seem to have any impact on industries ability to implement. But cumulatively, as all projects shrink, it has a major impact on the ability to maintain adequate infrastructure to accomplish your land management activities.	AFRC	The project has been designed to meet the purpose and need for the project, LRMP standards and guidelines, and NSO Recovery Plan and Critical Habitat Rule objectives.
Vegetation Management	We ask that you carefully assess and review proposed restrictions and mitigation items. It must be clearly documented they are needed	AFRC	Mitigations are imposed as needed to meet all laws, regulations, and policies.
Project support	Our organizations generally support	KSW	Thank your for your support!

	restoration forestry aimed at the ubiquitous tree plantations and small-diameter fire suppressed stands on national forest lands. We are particularly supportive of the proposed plantation thinning, hand piling and burning, and understory burning activities in the Gordon Hill project.		
Roads	We are extremely concerned about the proposed new logging road construction in this Key Watershed. As you know, the impacts of "temporary" road construction on soils, hydrology and vegetation are often long-term and significant. We would note that in the Big Flat HFRA project the Smith River NRA refrained from new road construction in undisturbed locations. We are troubled by the change in direction reflected in the Gordon Hill scoping notice. Creating new logging roads, yarding corridors, and log landings in this Key Watershed, while not proposing any reductions in the existing transportation system, is the direct opposite approach that the Northwest Forest Plan calls for in Key Watersheds.	KS Wild, KFA and EPIC	There was an error in the scoping document concerning new temporary road construction. The amount of new temporary road needed is 0.26 miles, not 1.6 miles as stated in the scoping document. There are 4new temporary roads being constructed. The longest segment in any one area is 0.11 mile (0.16 acres). The amount of acreage affected by all 4 segments is approximately 0.5 acres, but the area that these roads will allow to be treated (restored) is 50 acres. Temporary road width would be the minimum allowed, with minimal canopy loss. All temporary roads will be decommissioned after project activities are complete. The project is consistent with the Northwest Forest Plan, the Aquatic Conservation Strategy and Best Management Practices.
Roads	Why are no system roads proposed for decommissioning within this Key Watershed restoration project? Why not focus on the many forest restoration activities that can be accomplished from the existing transportation system without constructing additional logging roads in this Key Watershed?	KS Wild, KFA and EPIC	The Gordon Hill project does not propose any road decommissioning/restoration because the Smith River NRA Restoration and Motorized Travel Management EIS is in progress. The proposed action for the Travel Management EIS includes decommissioning approximately 46 miles of Forest roads and unauthorized routes that are located in the Gordon Hill Project Area.

Logging systems	We Are Concerned About Yarding Impacts. We remind the Forest Service that in LSRs, the goal of thinning projects is the attainment of late-successional characteristics. Wide yarding corridors, or the removal of large trees to facilitate yarding, may result in significant unanalyzed environmental impacts such as we witnessed in the Orleans HFRA project on the Six Rivers National Forest in which some units were comprised of up to 20 percent "add on" volume from yarding corridors.	KS Wild, KFA and EPIC	Yarding corridors will be kept to a minimum to meet canopy closure prescriptions. Any trees damaged by yarding that are not already marked for removal would remain onsite. Large trees will be maintained in all units (where they occur) and will not be cut to facilitate yarding corridors.
20 inch diameter trees	Large Trees Should Be Retained Throughout the Project Area. Page 9 of the scoping notice indicates that no trees over 20" inches will be logged within the LSR portion of this project. We recommend extending that diameter limit to the entire project. Logging large-diameter trees in a planning area in which they are in short supply is not "restoration" and will not reduce fire hazard	KS Wild, KFA and EPIC	The 20" DBH cut limit is required in the LSR to meet the S&G of the NWFP/LRMP; however, it is not based on silvicultural criteria. Stands were evaluated based on their current conditions and potential response to treatment. The purpose and need for the proposed action is to accelerate the development of late-successional habitat. To that end, commercial thinning prescriptions were designed to maintain the largest and healthiest trees in the stand. The stands selected for treatment are younger, predominantly even-aged stands. Within LSRs no tree >= 20" will be cut. Outside of LSRs, the silvicultural prescription of thin-from-below will still retain the largest trees within the stand.
Large trees/HFRA	Indeed, HFRA was specifically designed to emphasize the retention of large trees and old-growth stands. If the agency wishes to log large trees for timber production or economic objectives, then HFRA is the wrong planning mechanism.	KS Wild, KFA and EPIC	See above response. The project adheres to HFRA standards.
Logging in Riparian	It appears that the Forest Service is	KS Wild, KFA	The purpose and need for the Gordon Hill project is to

Reserves	proposing commercial logging within the Riparian Reserve land use allocation. The Aquatic Conservation Strategy (ACS) of the NW Forest only allows such logging if it is "needed" to attain ACS objectives. Perhaps some commercial logging in the Reserves is appropriate to restore existing plantations, but the agency will be hard pressed to show that logging is "needed" in young and mature natural stands. The yarding impacts in Riparian Reserves may be severe. We are extremely troubled by the agency's proposal to create logging corridors through the Reserves and to create "gaps" in the Riparian Reserves.	and EPIC	develop Late-Successional habitat on Forest Service lands. Development of Late-Successional habitat in managed stands is central to the Aquatic Conservation Strategy. This project proposes commercial harvesting within existing plantations, some of which contain Riparian Reserves. Riparian Reserve widths of 160 feet on each side of the stream channel have been designated. No heavy equipment will be permitted within the 160 feet Riparian Reserve. The stands selected for treatment are densely stocked plantations or younger, predominantly even-aged natural stands where thinning treatments within Riparian Reserves have been proposed to improve habitat conditions. All Riparian Reserves will have a no-treatment buffers established. No-treatment buffers are approximately 50 feet (TSI and fuels reduction) to 80 feet (commercial thinning) on each side of the stream channel (or to a defined break in slope, whichever is greater). The no-treatment designation provides an appropriate sediment filter buffer for any disturbed soil that may become mobilized as a result of the treatments. Only the outer portion of the Riparian Reserve will be treated. A minimum of 60% canopy closure will be maintained in commercial thinning units and 40% in TSI units, the largest trees in the stand will be maintained, and no heavy equipment will be used within designated Riparian Reserves. Any natural stand being treated was created from other disturbances, such as fire or mining. These stands are also densely stocked and homogenous. Treatments will accelerate the development of late-successional habitat characteristics in these areas, restoring riparian function.

			The ACS strategy not only allow for actions that improve riparian conditions, it is encouraged. The project is consistent with the ACS Strategy.
Road decommissioning	Hence we propose that the agency examine the possibility of closing and decommissioning roads (in addition to the temporary roads that are proposed for the project) as recommended by the applicable watershed analysis and late-successional reserve assessment.	KS Wild, KFA and EPIC	The Smith River NRA Restoration and Motorized Travel Management EIS is in progress. The proposed action includes decommissioning and restoration Forest roads and unauthorized routes throughout the Smith River NRA, including approximately 46 miles within the Gordon Hill project area. As stated in the scoping document, all temporary roads created specifically for the Gordon Hill project will be decommissioned after project implementation is complete.
Restoration	Restoration is More Than Thinning Trees. Comprehensive and balanced restoration includes but is not limited to: stream restoration, road decommissioning, thinning previously logged stands less than 80 years old, prescribed fire, soil rehabilitation, improving fish passage and erosion problems at road/stream crossings, creation of snags, placement of large woody material, and integrated weed management. Sound management of National Forests will require all these activities occur at the landscape scale to restore forested ecosystems.	KS Wild, KFA and EPIC	The Six Rivers is conducting these activities throughout the Forest in various projects, and specifically the Gordon Hill Project would restore conditions in riparian areas and previously logged stands, restore fuels conditions through the use of prescribed fire, and conduct noxious weed removal. In the long term, accelerating the development of young stands will create conditions that will generate large snags and large woody debris. Other projects in planning on the Smith River NRA will focus on stream restoration though road decommissioning and eliminating erosions issues.
Temporary Roads	Please note that while new road construction is often described by the agency as "temporary," that all new road construction results in long-term impacts to soil health and productivity. Further, once trees are removed from the roadway, they cannot be	KS Wild, KFA and EPIC	There was an error in the scoping document concerning new temporary road construction. The amount of new temporary road needed is 0.26 miles, not 1.6 miles as stated in the scoping document. There are 4 new temporary roads being constructed. The

	put back. Please note that the joint BLM and USFS Biscuit Fire Recovery Project DEIS found that "Creation of temporary logging roads is an irreversible commitment of the soil resource, as such areas rarely regain their former productivity."		longest segment in any one area is 0.11 mile (0.16 acres). The amount of acreage affected by all 4 segments is approximately 0.5 acres, but the area that these roads will allow to be treated (restored) is 50 acres. Temporary road width would be the minimum allowed, with minimal canopy loss. The amount of area affected in any one area would be insignificant. All temporary roads will be decommissioned after project activities are complete.
Temporary Roads	Attached these comments you will find a peer-reviewed article by Trombulack and Frissell (2000) detailing some of the negative impacts of road construction and use on Terrestrial and Aquatic ecosystems. The Forest Service must address and avoid the harmful impacts detailed in this study. *Scientific literature on the ecological effects of roads and found support for the general conclusion that they are associated with negative effects on biotic integrity in both terrestrial and aquatic ecosystems. Roads of all kinds have seven general effects: mortality from road construction, mortality from collision with vehicles, modification of animal behavior, alteration of the physical environment, alternative of the chemical environment, spread of exotics, and increased use of areas by humans. Road construction kills sessile and slow-moving organisms, injures organisms adjacent to a road, and alters physical conditions beneath a road. Vehicle collisions affect the*	KS Wild, KFA and EPIC	The longest segment in any one area is 0.11 mile (0.16 acres). The amount of acreage affected by all 4 segments is approximately 0.5 acres, but the area that these roads will allow to be treated (restored) is 50 acres. There are no riparian crossings and use will be short term and minimal. Temporary road width would be the minimum allowed, with minimal canopy loss. The amount of area affected in any one area would be insignificant. All temporary roads will be decommissioned after project activities are complete.

	demography of many species, both vertebrates and invertebrates; mitigation measures to reduce road kill have been only partly successful. Roads alter animal behavior by causing changes in home ranges, movement, reproductive success, escape response, and physiological state. Roads change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of runoff, and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone, and nutrients to roadside environments. Roads promote the dispersal of exotic species by altering habitats, stressing native species, and providing movement corridors. Roads also promote increased hunting, fishing, passive harassment of animals, and landscape modifications. Not all species and ecosystems are equally affected by roads, but overall the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems. More experimental research is needed to complement post-hoc correlative studies. Our review underscores the importance to conservation of avoiding construction of new roads in roadless or sparsely roaded areas and of removal or restoration of existing roads to benefit both terrestrial and aquatic biota. *-Trombulack, S.C. and C.A. Frissell. 2000.*		

	Review of ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14(1): 18-30.		
Temporary Roads	The following analysis provided by the BLM regarding the impacts of new "temporary" road on edge effects and microclimatic changes should be reflected in your forthcoming analysis: *Barricades, however, don't mitigate the edge effects and microclimatic changes that roads produce. Various studies (e.g., Ortega and Capen 1999; Marsh and Beckman 2004) show that the negative impacts of roads to wildlife habitat are not limited to the road prism –there is a zone of influence that extends into the adjacent habitat. For example, Marsh and Beckman (2004) found that some terrestrial salamanders decreased in abundance up to 80 meters from the edge of a forest road due to soil desiccation from the edge effects. Ortega and Capen (1999) found that ovenbird (a forest-interior species) nesting density was reduced within 150 meters of forest roads. This study suggests that even narrow forest roads fragment habitat and exert negative effects on the quality of habitat for forest-interior species. -Deadman's Palm EA III-110. Ashland Resource Area, Medford BLM.*	KS Wild, KFA and EPIC	Ortega and Capen found although ovenbirds did not actively avoid forest road areas, their territories tended to be larger near roads, potentially due to road edges having lower quality habitats. They also noticed that territory size increased as understory cover was reduced. The stands to be treated are young, even-aged stands that are densely stocked, with little to no understory. These stands do not contain the necessary characteristics for forest interior species. The short (one-tenth of a mile or less), roads widths will be the minimum allowed, with minimal canopy loss. There is no "adjacent habitat" that will be affected The longest segment in any one area is 0.11 mile (0.16 acres). The amount of acreage affected by all 4 segments is approximately 0.5 acres, but the area that these roads will allow to be treated (restored) is 50 acres. Temporary road width would be the minimum allowed, with minimal canopy loss. The amount of area affected in any one area would be insignificant. All temporary roads will be decommissioned after project activities are complete.
Temporary Roads	Please review the Ortega and Capen (1999) attached to these comments and the Marsh and Beckman (Edge Effects of Gated and Ungated Roads on Terrestrial Salamanders,	KS Wild, KFA and EPIC	See above response

	David M. Marsh, *The Journal of Wildlife Management*, Vol. 71, No. 2 (Apr., 2007), pp. 389-394) articles referenced by the Ashland Resource Area in the above quotation. The edge effects, microclimatic changes and soil desiccation acknowledged by the agency in these referenced papers must be disclosed and analyzed in your forthcoming NEPA document.		
Temporary Roads	An addition example of the scope of impacts from temporary road construction that must be analyzed in the forthcoming NEPA document occurs in the Klamath National Forest's DEIS for the Mt. Ashland LSR Project: *"Temporary spur road construction may increase road density, result in habitat fragmentation, increase edge habitat, and result in harassment to wildlife."* *Mt. Ashland LSR Project DEIS, 3-24.* Please ensure that the impacts of proposed road construction on road density, habitat fragmentation, edge habitat and wildlife harassment are well documented, or better yet, *avoided* in the Gordon Hill project.	KS Wild, KFA and EPIC	See above response
Soils	Please protect soils from compaction and displacement. Alternative methods of yarding and hauling should be utilized that prevent the compaction of soils. Tractor logging can cause serious impacts to soils as can cable yarding. The Forest Service should only log when the logging will be "carried out in a manner consistent with the protection of soil." 16 USC	KS Wild, KFA and EPIC	LRMP Standard and Guidelines limit the use of tractors to slope with 35% or less slope. LRMP Standards and Guides for soils limit the percentage of disturbed ground post project to 15% of the unit area. Soil scientists have been conducting fieldwork to determine pre project conditions. The soil scientist will

	§1604(g)(3)(F)(v); 36 CFR§219.27(c)(6). Management plans and projects must "insure that timber will be harvested from National Forest System lands only where—"soil, slope, or other watershed conditions will not be irreversibly damaged." 16 USC § 1604(g)(3)(E)(i). By enacting this section, Congress intended that the Forest Service "provide empirical guarantees that timber harvesting will not damage soils, water conditions, and fish habitats." Charles F. Wilkinson and Michael Anderson, Land and Resource Planning in the National Forests 161 (1987).		analysis the data and project design to determine if LRMP Standard and Guidelines would be met after project implementation. Numerous Project Design Features and BMPs have been developed to protect, minimize and rehabilitate the soils within the Gordon Hill project area.
Soils	Further, the NFMA regulations require the "conservation of soil and water." 36 CFR §219.27. Section 219.27(a)(1) provides that "[a]ll management prescriptions shall—[c]onserve soil and water resources and not allow significant or permanent impairment of the productivity of the land." Section 219.27(b)(5) provides that "[m]anagement prescriptions that involve vegetative manipulation of tree cover for any purpose shall— [a]void permanent impairment of site productivity and ensure conservation of soil and water resources." Further, [c]onservation of soil and water resources involves the analysis, protection, enhancement, treatment, and evaluation of soil and water resources and their responses under management and shall be guided by instructions in official technical handbooks." 36 C.F.R. §219.27(f).	KS Wild, KFA and EPIC	LRMP Standard and Guidelines limit the use of tractors to slope with 35% or less slope. LRMP Standards and Guides for soils limit the percentage of disturbed ground post project to 15% of the unit area. Soil scientists have been conducting fieldwork to determine pre project conditions. The soil scientist will analysis the data and project design to determine if LRMP Standard and Guidelines would be met after project implementation. Numerous Project Design Features and BMPs have been developed to protect, minimize and rehabilitate the soils within the Gordon Hill project area.

Neotropical Birds	The regional decline of migratory birds is a significant issue for this project. Numerous studies have reported local and regional trends in breeding and migratory bird populations throughout North America (e.g., DeGraaf and Rappole 1995, Sauer et al. 2004). These studies suggest geographically widespread population declines that have provoked conservation concern for birds, particularly neotropical migrants (Askins 1993, Terborgh 1989.) The 2005 report from the Klamath Bird Observatory entitled Local and Regional Trends in Breeding and Migratory Bird Populations in the Klamath and Rogue River Valleys: Monitoring Results for 1993-2003 may be viewed at http://www.klamathbird.org/resources This paper indicates that several species of songbirds are suffering declining population trends at the regional level. The forthcoming NEPA document for this project should analyze and disclose the potential impacts of conifer thinning operations and brush removal on neotropical bird population trends.	KS Wild, KFA and EPIC	The stands to be treated are young, even-aged stands that are densely stocked. These stands do not contain the necessary characteristics for forest interior species. Treatments are designed to accelerate the development of stand characteristics that will be suitable for a variety of species. Brush removal in the fuelbreaks will reduce a component of habitat for some understory species; however, the treatment will be limited to areas adjacent to high use roads. No overstory trees will be removed and current canopy closure will be maintained in most areas. No treatment buffers have been established in all Riparian Reserves. Fuelbreaks will provide protection to existing habitat. Direct, indirect and cumulative effects to neotropical migrant birds (NTM) for the project were analyzed and the findings disclosed in Chapter 3 of the EA.
Neotropical birds	The cumulative effects analysis on migratory birds should not rely exclusively on Wilderness, Riparian Reserves and LSRs to provide for species viability into the future, because many Forest Service and BLM Districts are actively logging those land use allocations, regardless of the effects on migratory birds, despite their reserve status. We refer you to the Biscuit fire salvage	KS Wild, KFA and EPIC	Cumulative effects to NTM for the entire project area were analyzed and the findings disclosed in the EA. The Forest does not evaluate the impacts to species based on land allocation.

	timber sale as one (very large) example.		
Neotropical birds	Simply concluding that the scale of the project is small, relative to the size of the nation, hence migratory bird populations will not be affected will not suffice. As you know, the Spotted Owl was driven into threatened status by lots of "little clearcuts" that individually were insignificant, but cumulatively resulted in extensive habitat loss.	KS Wild, KFA and EPIC	Impacts to TES, MIS, S&M, and NTM species were evaluated on the impacts to potential habitat at the project area scale and the findings disclosed in Chapter 3 of the EA.
Neotropical birds	Please develop and implement seasonal operational restrictions to avoid project impacts while land birds are nesting in the project area.		Operations need to occur at specific times to avoid damage to soil resources; however, the stands to be treated are young, even-aged stands that are densely stocked. These stands do not contain the necessary characteristics for forest interior species.
Pacific Fisher	We hereby identify the project's potential impacts on Pacific Fisher populations, connectivity and habitat as a significant issue for this project.	KS Wild, KFA and EPIC	As stated above, the stands to be treated are young, even-aged stands that are densely stocked. These stands do not contain the necessary characteristics for the fisher. Camera stations have been deployed in the project area within and adjacent to proposed units, with three detections. A limited operating period has been imposed for any treatment within suitable denning habitat within 0.25 miles of the detection sites. The project will maintain current fisher habitat, will accelerate the development of fisher habitat in these young stands, and will not cause disturbance to fisher during the breeding season. The project will not adversely impact the fisher; therefore, this does not represent a significant issue for the project
POC	I didn't include a lot in the scoping comments regarding the POC spots that we talked about in the field, but I sure hope you'll be considering them as the project moves	KS Wild, KFA and EPIC	A POC risk assessment has been completed. LRMP standards and guidelines for POC protections will be implemented for this project.

	forward.		
Project location reporting vs. project size	The scoping notice states this will be an HFRA project to reduce fuels near communities. Yet the scoping notice only listed the township and range, but not the section numbers. If you simply consider the township and range the project area is enormous and many areas would not qualify as a WUI. The scoping notice also does not state how far away the project area is from the nearest communities that will allegedly benefit from this project. This information needs to be disclosed.	Conservation Congress and Wildland Guardians	Not listing the sections numbers was an oversight and they are provided in the Environmental Assessment (pg. 4) for the project; however, a map was provided with the scoping package showing all the treatment areas as well as the communities of Gasquet and Big Flat. The scoping document explains that the fuel break, as recommended by the Del Norte Fire Safe Council Community Wildfire Protection Plan, will provide protection "along major travel routes that are important evacuation routes in the event of wildfires. The Gordon Hill Project will connect and enhance the two previously completed community protection projects by treating fuels along a main travel route between these communities, protecting an important evacuation route, and providing a break in the continuity of fuels. The strategic shaded fuelbreaks and other treatment areas are intended to reduce hazardous fuel loading to retard the spread of fire and provide fire suppression personnel a higher probability of successfully attacking a wildfire"
Protecting communities	USFS wildfire researcher Jack Cohen states the most significant way to protect communities is for the people living in them to reduce fuels around their property. "Analyses of both fires indicate that home ignitions depend on the characteristics of a home and its immediate surroundings. Howard et al. (1973) observed 95 percent survival for homes with nonflammable roofs and a vegetation clearance of 10 to 18 meters. Foote (1994) observed 86 percent	Conservation Congress and Wildland Guardians	The Smith River NRA is continuing to collaborate with the Del Norte Fire Safe Council and Cal Fire to complete work on private property adjacent to the Forest Service projects to strengthen the effectiveness of the fuels reduction projects.

	survival for homes with nonflammable roofs and a clearance of 10 meters or more (Cohen 2000).		
Fuel treatments vs. harvesting	Logging in the National Forests does little to protect communities from wildland fires and in many cases exacerbates fires once they start. The scoping notice states the majority of fires are human caused on roadways so it would make more sense for the Forest to close some roads to prevent fire rather than log the NF. Regardless, the Forest must demonstrate the use of the best available science regarding wildland fire and WUI's, including the USFS own research.	Conservation Congress and Wildland Guardians	The project objectives involve fuels reduction as well as restoration of younger even-aged stands. The fuelbreaks are located along high-use County and Forest Service roads, many of which access private land. The prescriptions are designed to accelerate the development of the younger stands, but will also reduce the incidence of crown fires by reducing crown density in the treated stands and shift the structure from densely stocked, even aged stands to stands with increased horizontal and structural diversity. For detailed information on how the prosed fuels treatments were developed, please refer to the Fuels Report for the Gordon Hill Vegetation and Fuels Management Project (Balent 2014).
Biology and Critical Habitat	Much of the project area is in an LSR and there is one mention of critical habitat. The designated critical habitat unit(s) must be disclosed; the number of NSO Activity Centers with habitat acreages for N/R/F must be disclosed for each AC; and the number of owls and owl pairs found in the project area from surveys must be disclosed.	Conservation Congress and Wildland Guardians	The type of information requested is provided in the environmental document after issues have been identified through public scoping. See the Wildlife Section (EA pgs. 136 to 189) for detailed information as requested.
Diameter limits in LSR	The scoping document states the project area is limited in late-successional habitat and wants to protect existing late-successional habitat, yet intends to commercially thin and reduce fuels in mid-mature and late-mature habitat. There is no legitimate reason to log mid and late-mature habitat if late-	Conservation Congress and Wildland Guardians	No commercial thinning will occur in late-mature habitat, and only minor amounts of even-aged mid-mature habitat will receive any treatment. No northern spotted owl nesting/roosting habitat and only low quality foraging habitat will be commercially thinned. Treatments are designed to develop the critical stand characteristics required by the NSO that are currently lacking in all the

	successional habitat is lacking for owls and other late-successional species. The project doesn't include diameter limits, but does include "variable thinning." It should have diameter limits of 8" DBH and below, especially in CHU/LSR, to reduce the smaller trees. Variable thinning should not be permitted in LSRs or designated critical habitat under any circumstances. This discretion should not be given in these areas because there is no guarantee large diameter trees won't be logged, especially when the Forest has already admitted late-successional habitat is proposed for thinning and fuels reduction.		stands proposed for treatment. No large diameter trees will be removed anywhere in the project. No late-successional habitat is proposed for thinning and fuels reduction is limited to brush and small diameter trees (8" or less) only within 50 ft. of the road. The types of treatments proposed in this project are not only allowed but are actively encouraged in the Northwest Forest Plan for LSR protection and development, as well as in the 2011 NSO Recovery Plan and the 2012 NSO Critical habitat Rule.
Biology, Harvesting in NSO sites	We also strenuously object to any activities in owl core nest areas. Particularly if these nest cores are below established habitat threshold values currently. This information should have been disclosed and must be disclosed in the next document the Forest produces for public comment.	Conservation Congress and Wildland Guardians	Treatments in NSO core areas (0.5 mi from the nest) are limited to those that will treat currently unsuitable or very low quality habitats to restore conditions within the ACs, consistent with the 2011 NSO Recovery Plan As stated above, this type information is provided in the environmental document after issues have been identified through public scoping, not in the scoping document itself.
EIS vs. FONSI when NSO are present	One thing is patently clear from the limited information disclosed: an EIS is required for this project because it simply can't be supported by a FONSI. Due to the presence of NSO, survey and manage species, riparian reserves, wild & scenic river, erodible soils with mass wasting potential, water quality issues, etc. an EIS is required	Conservation Congress and Wildland Guardians	The project has been designed to avoid impacts to the resources listed by the commenter. An EIS is required when significant issues are identified. No significant issues have been identified for this project; therefore, an EIS is not required.
Harvesting in	We do not agree with the premise that	, Conservation	The types of treatments proposed in this project are not

critical habitat and LSRs	designated critical habitat and LSRs should be commercially thinned with fuels reduction to prevent wildfire. The best available science does not support the premise that these activities are needed in owl habitat. We doubt seriously that any human being is living in designated critical habitat/LSR.	Congress and Wildland Guardians	only allowed but are actively encouraged in the Northwest Forest Plan for LSR protection and development, as well as in the 2011 NSO Recovery Plan and the 2012 NSO Critical habitat Rule, all which were developed using the best available science. Fuels treatments are not only to protect humans, but to also protect currently suitable NSO habitat.
Decommissioning roads and landings post project	The project will require temporary road construction; roads be reopened; road maintenance; etc. The scoping document states temporary roads will be decommissioned after project implementation, yet also states further treatments will be needed every 3 to 5 years to maintain the fuel reductions. How will these roads ever be closed/decommissioned with constant reentry required? No temporary roads or any other roads should be constructed in designated critical habitat or LSR. The same is true for landings.	Conservation Congress and Wildland Guardians	Temporary roads and landings are utilized for commercial harvesting operations only. Initial treatments or maintenance of fuel treatments does not require the use of temporary roads. Temporary roads will be decommissioned once commercial operations have been completed.
Cumulative effects of connecting projects	The scoping document lists numerous other projects as “connected” actions. We are very concerned about cumulative effects to TES species; habitat fragmentation; loss of connectivity; and a declining owl population. It’s clear this project will likely adversely affect the owl’s prey species and may actually “take” owls if activities are conducted in nest core areas. We are also concerned about smoke and noise disturbance to owls. This project will require formal consultation with the FWS.	Conservation Congress and Wildland Guardians	Direct, indirect and cumulative effects to threatened, endangered, and Sensitive species (TES), for the project were analyzed and the findings disclosed in the EA. The project was designed to avoid adverse impacts to the NSO. No habitat will be removed and all actions will improve low quality habitat. LOPs will be imposed within 0.25 miles of NSO activity centers. The project will not adversely affect the owl, and formal consultation will not be required. The USFWS concurred with this determination.

	Shaded fuelbreaks, temporary roads, and landings all remove habitat. This removal of habitat should not occur in designated CHU/LSR. The Forest must update its Environmental Baseline for the NSO and consider all of the connected actions listed on page 2 of the scoping document. There are also private lands adjacent to the project area. Are these industry lands and if so how much, if any owl habitat do these lands provide? The Forest must conduct a substantive cumulative effects analysis that complies with both NEPA and the ESA for this project.		No late-successional habitat is being removed. Fuels reduction will only occur within 50 ft of a high use road in late-successional habitat. All late-successional habitat will remain functional immediately post-project The majority private lands within the project boundary are owned by individuals, although one area within a large Jeffrey pine grassland area (no NSO habitat) is owned by a corporation. A cumulative effects analysis is provided in the EA (EA Appendix D and Chapter 3 for each specific resource area) and the BA (pgs. 79-83)
NSO and barred owls	How will this project harm NSO and exacerbate Barred owl encroachment? The Forest should adopt the precautionary principle for any activities involving NSO habitat.	Conservation Congress and Wildland Guardians	The project will not harm the NSO. It is designed to protect current moderate and high quality habitat, improve low quality habitat, and accelerate the development of plantations and young natural stands less than 80 years old to create additional habitat. These actions are in compliance with the 2011 NSO Recovery Plan and the 2012 CHU Rule. The 2011 RP addresses the threat to the NSO from the barred owl through the preservation of existing high quality habitat (Recovery Action 32) and preservation of high priority NSO territories (Recovery Actions 10). The RP also addresses the need to restore additional habitat for the owl in order to ameliorate the impact of the barred owl. Surveys for this project found 3 barred owls. While additional barred owls may or may not be present in the action area, implementation of RA 10 and RA 32 fully meets the best available barred owl mitigation measures by protecting and restoring spotted owl habitat.

			The 2011 RP was informed by Forsman et al 2011 and Dugger et al (in press at the time but subsequently published). The RP states due to "The continued decline of the spotted owl populations and low occupancy rates in large habitat reserves, and the growing negative impact from barred owl invasions of spotted owl habitats (Forsman et al. 2011, Dugger et al. in press), which is greater than anticipated in the NWFP. We recommend **increased conservation and restoration of spotted owl sites and high-value spotted owl habitat** to help ameliorate this impact". Emphasis added Without the implementing the additional protection measures and recovery actions of the 2011 RP, the barred owl may be successful in out-competing the spotted owl. It is imperative to the spotted owl's recovery to take such actions. The project will meet the objectives of the 2011 RP.
Riparian protection	Due to past logging and current soils and water quality, we don't possibly see how the Forest can attain ACSO in Riparian Reserves. A substantive analysis must be conducted to demonstrate compliance. The Forest must also demonstrate compliance with the Wild & Scenic Rivers Act.	Conservation Congress and Wildland Guardians	All RRs proposed for commercial and precommercial thinning are young, even-aged stands. These stands were clear cut up to 60 years ago (see the Fisheries and Aquatic Resources baseline discussions and tables in the EA and the Hydrology Assessment for description of current stand conditions). Past management practices did not buffer riparian areas; therefore they require thinning to improve stand conditions and to meet ACS objectives, including the future recruitment of large woody debris. Implementation of the project would maintain and improve riparian habitat conditions. Treatments are designed to benefit RRs and accelerate tree growth and the development of late-successional habitat. Implementation of the project would maintain

			and improve riparian habitat conditions for wildlife. Despite past land management activities, the Smith River watershed has excellent water quality. It is one of the very few watersheds in the North Coast Region that is not listed as impaired and does not have a TMDL (total maximum daily load) allocation. Thinning in young, dense plantations will accelerate Late-Successional habitat and help to attain ACS objectives in the project area. No activities will occur within river corridors designated as Wild and Scenic River. Minor fuels treatments will occur within Lower Hurdygurdy Recreational River corridor (EA pg. 5). The project is in compliance with the Wild & Scenic Rivers Act.
Legal Notice and reports	We request that the Legal Notice for this project; all of the specialist reports; and the FWS consultation all be posted on the SRNF website for easy access by the public.	Conservation Congress and Wildland Guardians	The project reports are filed on the Region 5 Planning, Appeals, and Litigation website and available for public review: http://www.fs.usda.gov/goto/srnf/gordon-hill
Northern spotted owl	The state of CA recently reviewed an uplisting petition for the NSO and stated uplisting the owl to "endangered" may be warranted. Despite 20 years of the NWFP the owl continues to decline throughout its historic range and the FS' incessant, relentless logging of designated critical habitat/LSR is the main reason for this decline. The Forest should adopt the precautionary principle for any activities involving NSO habitat.	Conservation Congress and Wildland Guardians	Treatments are designed to develop the critical stand characteristics required by the NSO that are currently lacking in all the stands proposed for treatment. The types of treatments proposed in this project are not only allowed but are actively encouraged in the Northwest Forest Plan for LSR protection and development, as well as in the 2011 NSO Recovery Plan and the 2012 NSO Critical habitat Rule.
Riparian standards	The Basin Plan contains water quality	North Coast	This project is not located within a TMDL listed

	objectives, implementation plans for meeting those objectives, and other policies, including State Water Resources Control Board and federal policies, which are applicable to operations on National Forest System lands within California. The SRNF Gordon Hill Vegetation and Fuels Management Project must be designed and implemented to meet the water quality standards outlined in the Basin Plan. Additionally, the project must be in compliance with any total maximum daily load (TMDL) that has been developed for the watersheds in which the project will occur.	Regional Water Quality Control Board	watershed. Despite past land management activities, the Smith River watershed has excellent water quality. It is one of the very few watersheds in the North Coast Region that is not listed as impaired and does not have a TMDL (total maximum daily load) allocation. The proposed action will comply with the Clean Water Act, Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board waiver (Order No. R1-2010-0029).
Riparian: NCRWQCB enrollment for Waiver	For project enrollment, the 2010 Waiver states that after the Project Decision Notice is signed and at least 30 days prior to commencement of on-the-ground activities, a Notice of Intent (NOI) and Waiver Application shall be filed with the Regional Water Board. The NOI certifies that the USFS understands and intends to comply with the Waiver. A letter granting coverage must be received prior to initiating activities.	North Coast Regional Water Quality Control Board	This project has been designed to comply with the California Regional Water Quality Control Board, North Coast Region, Waiver of Waste Discharge Requirements (Order No. R1-2010-0029).
Riparian: NCRWQCB General Condition #3 (page 14)	General Condition #3 (page 14) states the condition requires the USFS to inventory, prioritize, and schedule for treatment existing legacy sediment sites that are in the project area as part of the proposed project, or identify the existing larger watershed planning effort (e.g. Watershed Analysis and Restoration) that will accomplish the same.	North Coast Regional Water Quality Control Board	Silvicultural projects that were significantly started prior to June 2010 can still apply for a water quality waiver under the previous silvicultural waiver (Order R1-2004-0015). It has been agreed by the Regional Board and the Six Rivers NF that the Gordon Hill project will meet the eligibility criteria and compliance of the "old waiver, Order R1-2004-0015."
Riparian:	To provide clarity, transparency, and	North Coast	This project has been designed to protect water quality.

NCRWQCB General Condition #10 (page 15)	improve our ability to assess compliance with water quality objectives, General Condition # 10 (page 15).	Regional Water Quality Control Board	All applicable Best Management Practices (BMPs) will be described and included in the Environmental Assessment.
Riparian: NCRWQCB General Condition #11 (page 15)	General Condition #11 (page) states "In addition to providing specific on-the-ground prescriptions, the USFS shall provide copies of this Waiver to contractors and grazing permittees, and USFS volunteers or any other third parties specified in this Waiver, and notify them of their responsibilities to comply with the Waiver."	North Coast Regional Water Quality Control Board	The Forest will discuss and provide copies of the waiver conditions to all parties involved in the implementation of this project.
Riparian: NCRWQCB General Condition #1 (page 13)	General Condition #11 (page 15). Designated riparian zone widths. See comments for excerpt.	North Coast Regional Water Quality Control Board	This project has been designed to protect water quality. Appropriate Riparian Reserve widths have been delineated for all treatment units.
Riparian: mitigate water quality impacts (page 23, item "g")	Measures to mitigate water quality impacts should be included in the design of the SRNR Gordon Hill Vegetation and Fuels Management Project. The 2010 Waiver Application requirements (page 23, item "g") states that an application must contain: "Copies of relevant portions of all environmental documents that set out the details of a project, especially on-the-ground prescriptions, including supporting documents that describe in detail the activities and management practices that will be taken to reduce potential water quality impact to less than significant levels (e.g., NEPA documents, technical reports, design criteria, assessments, watershed restoration plans)."	North Coast Regional Water Quality Control Board	This project has been designed to protect water quality and to meet all conditions necessary to comply with The Waiver.
Riparian: Waiver	The Waiver Monitoring and Reporting	North Coast	This project has been designed to comply with The

Monitoring and Reporting Program (Page 2)	Program (Page 2, USFS-Wide Monitoring, Administrative Implementation Monitoring) states: "All projects in Waiver Category B will have administrative implementation monitoring using a "checklist" approach. All on-the-ground prescriptions for the project must be included in the checklist so that the monitoring constitutes 100% implementing monitoring.	Regional Water Quality Control Board	Waiver.
Interrelated components	We are very supportive of the subject project…we especially like the interaction on the components (fuel breaks, habitat restoration, commercial harvesting and T.S. improvement). We also like the fact that your proposed action and project description does a job linking back to the CWPP + several past actions + projects. Thank you!	Smith River Alliance	Thank you for your support!
Fuel loading	The fuel loads are too heavy.	Thomas Scarlett	One of the purposes of the project is fuels reduction.
2nd growth stand thinning	Your 2nd growth stands need commercial thinning.	Thomas Scarlett	One of the purposes of the project is to restore habitat through commercial thinning of plantations and young, natural stands.
Accountability	You could produce a product instead of sucking the tax payers dry.	Thomas Scarlett	The project will produce approximately 4 MMB

Appendix D: Cumulative Effects Analysis

Cumulative effects analyses are conducted at various temporal and spatial scales, depending on the resource value analyzed. The following section provides an overview of the past, present, and reasonably foreseeable future actions or events that occur within the bounds of the Gordon Hill Project area.

Past, Present, and Reasonably Foreseeable Future Actions
On Federal lands, past actions and events included timber harvesting, mining, recreational trail projects, and wildfires. Road building, including temporary roads and skid trails, has occurred throughout the watersheds, generally associated with timber harvesting and mining.

Reasonably foreseeable future actions include private, county, state, and federal actions that are in any stage of project planning and those for which decisions have been made and are awaiting implementation.

Timber Harvest

Timber harvest activities and the suppression of wildfire in the Smith basin has led to changes in seral stages and increases in fuels. This shift in seral stage distribution is highest in the tanoak and Douglas-fir series, due to harvest of commercially valuable old-growth Douglas-fir stands that began in the late 1950s. There has been a reduction in old-growth forests and an increase in shrub, pole, and early mature forests.

Most of this harvest activity was concentrated on the lower 1/3 slope in the Douglas-fir and tan oak series. Within the 42,724 acre project area, approximately 7,407 acres are now in the younger seral stages. Of the 7,407 acres, 6,299 acres occur in the tan oak with Douglas fir overstory series (32% of the series in the project area) and 770 acres occur in Douglas fir series (11% of this series).

Since the 1990 NRA Act, the majority of the vegetation management projects have involved thinning plantations and young natural stands to accelerate the development of late-successional characteristics for the benefit of fish and wildlife as well as to reduce fuel loading to protect existing late successional habitats.. Ecological restoration of upland and riparian habitats and processes can be accelerated with active management.

Mining

Past hydraulic mining, primarily for gold, altered certain stream channels, including Hurdygurdy, Craig's, and Coon Creeks. Hydraulic mining altered channels and riparian areas significantly. Huge volumes of hillslope sediment were washed down to riparian and streamside areas and large woody debris (LWD) was removed from the channel in

order to mine alluvial gold deposits within the substrate and near the channel. The removal of LWD reduced habitat complexity, LWD recruitment potential, and the ability of the channel to store and route the introduced sediment. Much of the landscape where hydraulic mining occurred is recovering, and previously altered riparian stands in these areas are approaching 70 to 80 years and are beginning to provide Riparian Reserve functions.

Fire

Historical records and fire evidence show that fires regularly occurred in this area with a variety of fire frequencies and intensities. Both wildfires and their exclusion through aggressive suppression affect plant and animal habitat, including stand structure, number of standing snags, amount of large woody debris, soil organic matter content, nutrient availability, and erosion hazard.

The dramatic reduction in wildfire burn acreages over the last 80 years appears to have resulted in unnatural fuel profiles that are more continuous, both horizontally and vertically. Given this increased conifer density, future wildfires could become larger and more destructive than in the past.

In the prolonged absence of fire, and aggravated by other disturbance factors, these fire-adapted forests and grasslands have undergone significant changes in species composition and structure. Intermediate canopy layers and higher ground fuel loadings have developed which allow ground fires to reach the crown more easily, making fires more difficult to control. Young plantations now occupy most of the harvested old-growth sites within the project area. Early and mid seral stages of Douglas-fir are more susceptible to mortality by wildfire than older late seral stands. Thick, corky bark on the lower bole and roots of older trees protects the cambium from heat damage. In addition, the tall trees have their foliage concentrated on the upper bole, which makes it difficult for fire to reach the crown; however, trees are typically not free of lower branches until they are more than 100 years old (Hermann et al, 1990). Stands selected for treatment in project area are predominantly 80 years old or less.

The high stem densities in plantations and younger stands also results in greater fire risk. Fire suppression activities have significantly reduced the amount of fire over the past 50 years leaving high fuel loads in places which threaten the resiliency of the upland and riparian habitats in the event of a wildfire. In addition to these past activities, road building has cut across numerous riparian reserves and fragmented habitat in multiple locations throughout the project area which has the potential to alter the sediment routing within the riparian reserve.

Smith River NRA Act

The cumulative effects of past management activities such as timber harvesting, road building, mining, and fire suppression has resulted in many upland habitats and riparian

areas with altered function and processes. However, the future options of timber harvest, road construction, and mining were largely determined through the passage of the 1990 Smith River NRA Act, as well as through designation much of the timber management zone as Late-successional Reserves under the goals of the Standards and Guidelines for *Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USFS/BLM 1994). The entire Smith basin is a Key Watershed. The NRA Act legislated management direction through eight management zones and Streamside Protection Zones. Streamside protection legislated in the NRA Act meets and, in some instances surpasses, the goals of Riparian Reserves in the Aquatic Conservation Strategy.

The general trend of most parts of the basin is recovery of erosional processes at various stages from recent to near complete from the period of intensive road-building and logging of the '60s, '70s and '80s, as well as the natural disturbances of the 1955 and 1964 floods, as well as lesser floods of 1975, 1986 and perhaps 1994. Recovery from these disturbances is an ongoing, irregular process; some areas in partial recovery (revegetation and armoring of surfaces left by erosion and landsliding) have been partly reactivated by subsequent disturbances.

The trend for upland and riparian habitats on the NRA is towards recovery. Since the 1990 NRA Act, timber harvest on the NRA has been geared towards restoration of late-successional characteristics and habitat development (thinning in younger stands). Fuel treatments were designed to help restore natural fire regimes. In the long term, the Gordon Hill project will benefit fish, wildlife and plant species.

Reasonably Foreseeable Actions

Reasonably foreseeable future actions include private, county, state, and federal actions that are in any stage of project planning and those for which decisions have been made and are awaiting implementation.

The project area incorporates private land in the French Hill, Coon Mountain, Paradise Flat, and Tyson Mine areas. Private land activities include agriculture, domestic use, and timber harvest. Timber harvest has occurred and is expected to continue on the privately owned timber ground. Currently there is no known private timber harvesting plans on other ownerships in the planning area, based on the CalFire website on 7/14/2014.

On Forest Service lands, projects have recently completed implementation, are being implemented, or are in the planning stage. The following is a summary of the projects in each category:

Implementation Complete

Coast to Crest Trail, signed 9/2007, Completed 2012

The project involved reconstructing four segments of the historic Kelsey Trail along the South Fork of the Smith River, a portion of which occurs in the Gordon Hill project area. The Coast to Crest Trail project reconstructed 10.65 miles of river-based non-motorized backcountry trail of approximately 3 foot-width for pedestrians and equestrians. The segments within the Gordon Hill Project area included:

Canthook Creek Trail segment Canthook Creek from its confluence with the Smith River to Hurdygurdy Creek (2.33 miles). This segment required a low water crossing at the Smith River. Some sections of the trail were missing and required reconstruction. The whole segment was brushed.

Hurdygurdy Creek Trail segment Canthook Trail intersection to its intersection with the Big Flat Trail (1.6 miles). This section required major reconstruction as most of the old historical sections had been obliterated.

Only brush and small diameter trees (less than 8" DBH) were removed during any stage of the project. No overstory trees were removed. All exiting snags and downed wood were retained, unless the former poses a safety hazard. Any snag felled for safety reasons was left on site as downed woody debris. Many sections of the trail already existed and had little or no vegetation removed.

Hurdygurdy Recreation Improvement Project, Signed 2/2005, Except for the Big Flat campground group site and water system development (which have been deferred), all actions were **completed by 2008**

The project area is located in the Lower Hurdygurdy Management Area (Area 6) on the Smith River NRA. This Area encompasses 4,000 acres in the lower Hurdygurdy watershed.

The purpose of the Hurdygurdy Recreation Improvement Project was to 1) protect fisheries and wildlife resources, and water quality from impacts resulting from unmanaged recreation and 2) improve the recreation experience for all users. Cumulative impacts from long-term unmanaged dispersed recreation in this area had developed, including loss of ground cover, soil erosion and compaction, sedimentation, damage to riparian vegetation, and water quality degradation due to lack of sanitation facilities. There were risks to resources in the project area from stream bank erosion, sedimentation, and petrochemicals from unregulated motor vehicle access along Hurdygurdy Creek. Water quality issues were based on the concern for public health and safety from the lack of adequate sanitation facilities and the potential for contact with human waste. The project was designed to manage recreation activities and vehicle access and improve recreation facilities in the Lower Hurdygurdy

The objectives for the project included the designation of vehicle access routes and development of parking areas, installation of new sanitation facilities, and designation of camping and day-use areas. The project included actions on nine dispersed recreation

sites and one developed campground. Specific actions included:

1) Installation of permanent vault toilets at Chimney Flat and Dry Lake, and a seasonal portable toilet at the Fox Flat access.

2) Maintenance on the Chimney Flat access road (Forest Road 15N57), including replacement of three existing cross drains with four new cross drains, and installation of a crossing at the intermittent seep channel at the end of the road. This improved drainage, reduced surface erosion, and provided safe access for low clearance passenger vehicles.

3) Motorized vehicle access was provided directly to seven dispersed sites: Dry Lake, Horse Flat, China Flat, Hurdygurdy Bridge, Oro Grande, Chimney Flat, and Flat Camp; resulting in approximately 1.4 miles of motorized access. The non-system roads accessing these sites were added to the Forest transportation or trail system. Safe vehicle access was provided within 300 feet of Hurdygurdy Creek at Fox Flat and Hayden's Gulch. The upper flat portions of the non-system roads to Fox Flat and Hayden's Gulch were added to the Forest transportation or trail system. The remaining lower steep portions of these two roads were designated as non-motorized trails. Access to Chimney Flat is provided by Forest Road 15N57 as described above. Vehicle control devices and parking areas have been developed at all sites. Motor vehicles are only allowed on Forest Service system roads and motorized trails. A Forest Order was issued that would prohibit motor vehicle use off of system roads and motorized trails.

4) Conversion of 1.1 mile of unclassified roads to non-motorized trails.

5) Installation of picnic tables and fire rings at Chimney Flat.

6) Restoration of denuded and compacted areas to restore and protect habitat.

7) Designating Chimney Flat (site 8) as a day use area.

8) A seven day camping stay limit for sites Dry Lake, Horse Flat, China Flat, Hurdygurdy Bridge, Hayden's Gulch, Oro Grande, Fox Flat, and Flat Camp.. Big Flat Campground (Site 10) would continue to have a 14 day limit.

9) Development of an interpretive trail connecting the Big Flat Campground, Chimney Flat, and Fox Flat. The trail is approximately 2 miles long and developed using existing non-system roads and trails.

10) Improved layout of Big Flat Campground by relocating road and campsites.

11) Installation of new permanent vault toilets at Big Flat Campground.

12) Development of the Big Flat group camping facility with permanent vault toilets.

13) Road reconstruction at Big Flat Campground.

14) Removal of the dilapidated Big Flat Guard Station barracks and development of a group campsite in this location.

15) Development of a water system for Big Flat Campground.

Implementation in Progress

Big Flat Vegetation & Fuels Management Project, signed 9/2008

The Big Flat Vegetation & Fuels Management Project involves habitat restoration (thinning in younger stands) and fuel treatments to protect communities at risk, as well as to restore natural fire regimes and protect existing habitats. The Big Flat Vegetation Management and Fuels Reduction Project is currently being implemented and will improve habitat conditions on 1084 acres and conduct fuels reduction treatments on 735 acres.

Implementation will result in the treatment of vegetation and hazardous fuels on approximately 1,824 acres of conifer/hardwood stands and a meadow through commercial timber harvesting, timber stand improvement, and fuel reduction treatments. This alternative involves the following actions:

1. 503 acres of commercial thinning and activity fuel treatment in 40 to 45-year old plantations and natural stands. Commercial thinning will occur both within and outside of strategic fuelbreak areas. Of these acres, 356 acres will be ground skidded and 147 acres will be cable yarded.
2. 45 existing landings will be re-utilized.
3. 4.26 miles of existing temporary roads will be reutilized and subsequently decommissioned after harvest is completed.
4. 581 acres of pre-commercial thinning and activity fuel treatment in 20 to 30-year old plantations and natural stands. Pre-commercial thinning will occur both within and outside of strategic fuelbreak areas.
5. 735 acres of fuel reduction treatments employing manual, mechanical and prescribed burning methods in conifer stands in various seral stages within strategic fuelbreak areas.
6. 5 acres of prescribed burning in a meadow.
7. 24.9 miles of road maintenance on nine already open system roads and one non-system road.
8. 2.4 miles of road upgrade and subsequent re-closure after harvest is completed on five currently closed system roads.

Completed To Date:

- Approximately 548 acres of fuels treatment have been completed, Fuels treatments ongoing

- Approximately 175 acres of TSI treatments have been completed
- Approximately 408 acres of commercial thinning completed.

Coon Mountain Meadow Restoration signed on 3/2009.
500 acres treated to date

The Coon Mountain Meadow Restoration Project is using prescribed fire to reduce encroaching vegetation and restore a Jeffrey Pine grassland area. The Coon Mountain meadow area is approximately 750 acres. Fire exclusion has allowed vegetation such as brush and Douglas fir to encroach upon the meadow. Dense thickets of suppressed, small diameter pines (50+ years old) occur throughout the meadow.

The project will burn the entire meadow area over 5 years. Burning would occur when conditions are wet enough to minimize the impacts to the soil and to overstory trees. In some cases, large diameter (predominant) trees would have debris raked back from the base of the tree, to protect the trees during burning. In addition, some pretreatment (hand piling and burning) of brush and small diameter trees will be done in certain areas: 1) along the private land boundary to act as a fuel break and slow the rate of fire spread; 2) around large predominant trees to protect the trees during the understory burn; 3) dense brush patches within select areas to protect Forest Service Sensitive (FSS) plants where no understory burning will occur (brush will be piled and burned outside occupied FSS plant habitat); and 4) areas of extensive brush in order break up the continuity of fuels and maintain a low intensity fire. Maintenance burning will occur every 5 to 15 years as needed to maintain the grassland area.

Gasquet Community Wildfire Protection signed 6/2003; Supplemental Information Report signed 2/2009.

All acres treated by 2009
Maintenance activities on going

The project involved cutting moderate to heavy brush, seedlings, and saplings, and to limb lower tree branches to create a shaded fuel breaks in six areas adjacent to the Gasquet Community to increase fire protection from wildfires. Of the six areas, two occur partially within the Gordon project area.

<u>French Hill Trail Community Protection</u> (300 acres) - the project created a shaded fuel break along both sides of French Hill Trail from Highway 199 to the French Hill Road (County Road 411), for a total length of approximately two miles. Chainsaws and brush cutters were used and fuels were hand piled and burned,. Logs greater than 10 inches DBH were maintained. Residual trees were pruned 6-10’ from the ground surface.

Wagon Wheel Community Protection (61 acres) - the project created a shaded fuel break approximately 300' wide along both sides of French Hill Road (County Road 411) from the private land near Highway 199, uphill, for a length of approximately three miles. Chainsaws and brush cutters were used and fuels were hand piled and burned the piles covered for later removal by burning. Chipping of fuels adjacent to the French Hill Road will be allowed. Logs greater than 10 inches DBH were maintained. Residual trees will be pruned 6-10' from the ground surface.

Forest-wide Integrated Management of Invasive Non-native Plant Species, signed 5/2011.
Implementation on-going

The Six Rivers National Forest conducts manual treatment of invasive non-native plant species across the Forest. These aggressive, non-native plants negatively impact the ecological balance and diversity of native vegetation and in turn adversely affect soil stability, visual quality, wildlife habitat, rangeland, recreational and wilderness values. Treatment strategy follows the early detection/rapid response approach which emphasizes management of populations as soon as detected, before populations become too large for effective control. Treatments include one or more of the following: manual removal (hand pulling, digging with shovel or pulaski, or pulling with weed wrench); weed clothe placement to inhibit weed seed growth; mulching using native materials (chipped or finely masticated material) to cover a surface that has been treated to reduce the potential for weed seed establishment; revegetation to stabilize the treated area; and educational signing to both educate and prevent inadvertent disturbance that can set back restoration efforts.

Scope of the areas treated is typically less than one acre (infested) per site with a majority of sites less than 0.2 acres. Essentially the treatment work covers many sites comprised of small-sized populations across the Forest. Approximate acres planned for treatment per year is 30.

Planned Activities (Reasonably foreseeable actions)

Smith River Smith River National Recreation Area Restoration and Motorized Travel Management Project

This project has completed public scoping and an Environmental Impact Statement (EIS) is in preparation. This project action involves implementing the recommendations of the Smith River NRA Roads Analysis Process (RAP) completed in November of 2005, which includes re-classification of inventoried roads by objective maintenance levels, additions of non-system roads to the NFS system, and road decommissioning and restoration.

All action alternatives proposed for this project will reduce road/route miles within the Gordon Hill Project area. There will be a net reduction of road/route miles within the project area of between approximately 15.18 miles to 16.05 miles depending on the alternative selected.

Aquatic Riparian Restoration EA

This project is under development, a site specific proposal has not yet been developed. Following is the summary of the proposed project as it currently exists.

The overall purpose of this project is to identify the suite of instream restoration projects that can create habitat complexity in the short term through the addition of large wood and boulders in key stream reaches on the Forest, create off channel rearing habitat for over wintering survival, and in the long term, by speeding up the growth of conifers in the riparian areas. Potential actions include: improving conifer growth though thinning alders and competing vegetation; addition of in-stream woody debris; planting native species on disturbed ground in riparian areas and landslides; removing invasive riparian plant species; creation of off-channel/side channel habitat; modifying areas that are naturally or artificially impeding movement of fish at different life stages; reducing the impacts of past mining activities that are adjacent to streams; and where identified, other miscellaneous activities such as piping ditches, installing fish screens, and head gates and water measuring devices.

Appendix E: Best Management Practices- Water Quality and Invasive Plants

Water Quality

Best Management Practices are intended to provide suitable constraints and protection of water quality, soils and riparian resources management during project planning and implementation on National Forest System lands. Below is a summary statement for the Best Management Practices applicable to the Gordon Hill project. This summary includes the Pacific Southwest Regional BMPs (September 2000) and the National Core BMP's (April 2012). National Core BMPs are listed when a particular BMP is not already addressed by the Pacific Southwest Regional BMPs.

- **Practice 1-1. Timber Sale Planning Process (Pacific Southwest Region BMP).**
- **Practice 1-2. Timber Harvest Unit Design (Pacific Southwest Region BMP).**
- **Veg – 1. Vegetation Management Planning (National Core BMP).**

  Qualified individuals participate in the environmental documentation process to evaluate onsite watershed characteristics and design the sale to include site-specific prescriptions that address water quality concerns. The Gordon Hill project environmental analysis includes sufficient project design features to insure adequate protection of water quality occurs during implementation.
- **Practice 1-13. Erosion Prevention and Control Measures During Timber Sale Operations (Pacific Southwest Region BMP).**
- **Practice 2-2. Erosion Control Plan (Pacific Southwest Region BMP).**
- **Veg – 2. Erosion Prevention and Control (National Core BMP).**

  Purchasers or Contractors will submit erosion control plans to the Sale Administrator or Contracting Officers Representation before operations begin. The plan will reference or include Six Rivers NF Wet Weather/Winter Operation Standards (Revised 1/17/2012).
- **Practice 1-19. Streamcourse and Aquatic Protection (Pacific Southwest Region BMP).**
- **Veg – 3. Aquatic Management Zones (National Core BMP).**

  Riparian Reserves within or adjacent to treatment units have been delineated on the ground and will be included in the Sale Area or Project Area Maps. Sufficient project design features necessary to protect water quality and riparian resources

have been incorporated into the planning process and are documented in the Gordon Hill Project Environmental Analysis and the Hydrology Specialist Report.

- **Practice 1-16. Log Landing Erosion Control (Pacific Southwest Region BMP).**
- **Veg – 6. Landings (National Core BMP).**

  Landing locations are located to minimize the number of skid trail necessary to log treatment units. New or improved landings would be shaped to disperse drainage and direct run-off away from watercourses at the time of construction Most landings are pre-exiting but will require minor maintenance prior to use. Landings shall be waterbarred, sub-soiled or re-shaped as needed to minimize erosion and prevent sedimentation.

- **Practice 1-17. Erosion Control on Skid Trails (Pacific Southwest Region BMP).**
- **Veg – 5. Cable and Aerial Yarding Operations (National Core BMP).**

  Each skid road would be water-barred, where needed, as defined by the Timber Sale Administrators Handbook, erosion rating, and slope, before the sale or project is completed. To reduce erosion and the potential for compaction, tractor skidding would only be allowed when the top 10 inches of soil is dry. Six Rivers NF Wet Weather/Winter Operation Standards (Revised 1/17/2012) will be employed.

- **Veg – 8. Mechanical Site Treatment (National Core BMP).**

  Low pressure masticators may be employed to treat non-commercial vegetation and provide for fuel reduction in plantations. Appropriate use of masticators includes use of equipment on less than 35% slope and at least 50’ from designated Riparian Reserves. Mechanical equipment will be operated in such a manner that minimizes ground disturbance.

- **Practice 2-7. Control of Road Drainage (Pacific Southwest Region BMP).**
- **Practice 2-11. Control of Sidecast Material During Construction and Maintenance (Pacific Southwest Region BMP).**
- **Practice 2-22. Maintenance of Roads (Pacific Southwest Region BMP).**
- **Road – 4. Road Operations and Maintenance (National Core BMP).**

  All haul roads are pre-existing, no new road construction shall occur. NFTS roads utilized for project implementation shall be properly maintained to reduce potential adverse effects to water resources. Sidecasting may be permitted but only where designated by the Forest Service, at stable locations and away from Riparian Reserves. Wet Weather/Winter Operation Standards shall be employed on all roads utilized during for this project.

- **Practice 2-12. Servicing and Refueling of Equipment (Pacific Southwest Region BMP).**

  Appropriate locations for servicing and refueling of equipment shall be designed by the Forest Service and only at locations where spills will not be directed toward streamcourses.

- **Road – 5. Temporary Roads (National Core BMP).**

- **Road – 2. Road Location and Design (National Core BMP).**

  To avoid and minimize adverse effects to water quality, soil, and riparian resources all temporary roads utilized for this project are located on or near ridge tops, require no stream crossings and entail minor to heavy maintenance. Maintenance activities are focused on clearing of roadside vegetation and grading/blading of travelway. Ground disturbing work associated with temporary roads will occur during the normal operating season and when heavy precipitation and runoff is unlikely to occur. Temporary roads will be decommissioned when no longer necessary for project implementation.

- **Road – 6. Road Storage and Decommissioning (National Core BMP).**

- **Practice 2-26. Obliteration or Decommissioning of Roads (Pacific Southwest Region BMP).**

  NFTS roads placed in storage (maintenance level 1) and temporary roads to be decommissioned shall be left in a free draining and stable condition. Roads placed in storage shall not leave any drainage structures in place that have the potential to fail and risk sedimentation to streamcourses. None of the temporary roads to be utilized for this project have stream crossings or other drainage structures that require maintenance. All roads placed in storage or temporary roads decommissioned shall have vehicle barriers installed and left in a maintenance free condition.

- **Practice 6-1. Fire and Fuel Management Activities (Pacific Southwest Region BMP).**

- **Fire – 2. Use of Prescribed Fire (National Core BMP).**

  Fuel management projects will have management requirements, mitigation measures, and multiple resource protection prescriptions documented in the project planning and decision documents. The Project Design Features associated with the Gordon Hill project are documented in the EA and the Hydrology Specialist Report. Project Design Features are measures intended to maintain/protect water quality while prescribed fire activities are conducted.

- **Practice 6-2. Consideration of Water Quality in Formulating Fire Prescriptions (Pacific Southwest Region BMP).**

Field investigations will be conducted as required to identify site specific conditions which allow for the optimum and allowable limits for the burn to insure water quality protection. Burning will only occur after or during wet weather conditions.

- **Practice 6-3. Protection of Water Quality from Prescribed Burning Effects (Pacific Southwest Region BMP).**

  Burning shall only occur during or after wet weather conditions and outside of the 50 foot active stream channel buffer. All prescribe burning within the project will retain 30-50% of the existing duff and minimal to no bare ground is anticipated as a result of burning treatments.

- **Practice 1-22. Slash Treatment in Sensitive Areas (Pacific Southwest Region BMP).**

  No treatment buffer zones have been designated on the project map and marked on the ground with blue and white stripped flagging. Slash treatment methods will be limited to handpiling and subsequent burning outside of the 50 foot buffer. The Contract Inspector will inspect work completed for correct and satisfactory treatment of slash generated from the project.

- **Practice 1-4 . Use of Project Maps for Designating Water Quality Protection Needs (Pacific Southwest Region BMP).**

  A map is attached that displays the locations of the no treatment buffers adjacent to stream channels. These locations were also marked on the ground with blue and white stripped flagging. GPS points were taken that could be utilized by persons implementing this project to further insure all buffer locations are identified.

- **Practice 1-8. Streamside Management Zone Designation (Pacific Southwest Region BMP).**

  No treatment buffer zones on each side of the active stream channel will provide an adequate buffer to minimize potential for adverse effects to water quality from adjacent management activities. These locations have been marked on the ground with blue and white stripped flagging.

- **Practice 2-12. Servicing and Refueling of Equipment (Pacific Southwest Region BMP).**

  Servicing and refueling of mechanized hand held equipment will occur outside of the designated active channel buffers (minimum of 50 feet). No heavy equipment will be permitted within 160 feet of active channel designated as Riparian. Fuel or other petroleum projects will be kept in designated locations away from active stream channels.

- **Practice 2-24. Traffic Control During Wet Periods (Pacific Southwest Region BMP).**

  Roads that must be used during wet periods should have a stable surface and sufficient drainage provided to allow such use while at the same time maintaining water quality. Where wet season field operations are planned, roads may need to be upgraded or use restricted. The Six Rivers National Forest Wet Weather/Winter Operations Standards (Revised 1/17/2012) will be included in the Contract or Burn Plan.

Best Management Practices for Invasive Plants (April 2014) applicable to the Gordon Hill Vegetation and Fuels Management Project

Prevention- Terrestrial Invasive Plants

GP5. Actions conducted or authorized by written permit by the Forest Service operating on and outside the road prism (including public works, special-uses, and service contracts) will require cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering National Forest System Lands).

GP6. Each unit shall identify sites for Forest Service vehicle cleaning and equip the sites sufficiently (i.e. high-pressure hose) to ensure mud or vegetative material trapped in tires or on the carriage of the vehicle can be effectively removed.

GP7. If there is a moderate to high risk of spreading invasives from an infested area to an uninfested area during operations and alternate project design features are not feasible to reduce risk of spread, equipment/machinery shall be cleaned prior to leaving the infested area and operating elsewhere.

GP8. When needed to control soil erosion, use mulch from chipped or masticated material or mulch native material or certified weed-free straw (see www.cal-ipc.org/ip/prevention for a weed-free forage and straw supplier list).

GP9. Rock, sand or other material to be used for projects conducted or authorized by the Forest Service shall originate from a weed-free source. Rock source shall be inspected by staff trained in invasive plant identification or if source is off-forest, contractor shall provide documentation that material is weed-free.

GP10. Material excavated at a project site that is contaminated with invasive plants can be a. reused at the site, b. stockpiled on site or c. relocated to an area that is already contaminated. During transport of contaminated soil or sand, cover material with an impervious material.

GP15. Locate activity boundaries or areas of concentrated use to exclude areas infested with invasive plants. Activity boundaries include staging areas, parking areas, trailheads, river access points, roadside pull-outs, and timber harvest landings.

Timber and Fuels

TF1. In planning fuel treatment projects proximal to settings with invasive plants (e.g. road edges), consider the risk of invasive plants spreading into the treatment area. Where the risk of spread into the treatment area is moderate to high (e.g. invasive plant cover is relatively high along the road edge where treatment is planned to occur), incorporate design features to reduce the spread of invasives. Examples of such features are below.

- For manual/hand-removal treatments or mechanical treatments, remove only enough vegetation and ground cover in the treatment area to accomplish fuel management /resource objectives; retain patches of shrubs and ground cover.

TF2. Prior to implementation of timber operations, where the risk of spread is moderate to high, via contractor or force account, treat invasive plant-infested road medians, landings, processing areas or other clearings used in the course of project implementation proximal in time before the start of operations. Treatment may include machine removal, weed whacking, or hand treatments. Invasive plants or shrubs removed shall be located on the edge of the clearing out of the way of operations to avoid retrieval on equipment.

TF4. Where the risk of invasive plant spread and establishment is moderate to high in association, with landings, processing or staging areas… after their use, employ one of the following measures to cover the disturbed area:

- distribute masticated material or mulch native plant material/wood straw to a depth of approximately 3-5 inches,
- distribute logging-related slash (e.g. tops, bark, limbs) that is crushed/condensed in such a manner that this material is close to the ground providing moderate to high shade to the ground, and,
- if feasible/practicable, decompact/rip and revegetate area with suitable native planting stock that optimizes resistance to invasive plant establishment (e.g. tree stock, early-successional/disturbance tolerant shrubs).

TF5. If applicable, implement timber as well as subsequent fuels activities according to a progression of work which prioritizes operating in relatively invasive plant-free sections of the planning area before moving equipment and general operations to areas of

the project where invasive plants are present. As an example, along a given primary FS route, first conduct work in those units located in the upper watershed where invasive plant cover is lower before operating machinery in units off the portion of the road in the lower watershed position where invasive plants are more common.

Roads

RD5. Incorporate, where applicable, the following into Forest road decommissioning projects to reduce the risk of an existing invasive plants occurrence from spreading occurrence to unoccupied areas as a result of project implementation:

- where there is a risk of spread of invasive plants from an existing occurrence on or along the road to be decommissioned into unoccupied wildland settings (e.g. in settings where the vegetative ground and canopy cover in the adjacent habitat is minimal), remove entire plant (including roots) mechanically or manually prior to decommissioning,

- mechanically or manually remove any invasive plant occurrence (remove entire plant) at the intersection of the decommissioned road and Forest system road.

    - Apply ground cover in the form of native mulch/finely masticated material or mulch material spread to depth of 6” over the area where plants were removed, or ,

    - If feasible, decompact/rip and revegetate area with suitable native planting stock that optimizes resistance to invasive plant establishment (e.g. tree stock, early-successional/disturbance tolerant shrubs).

Appendix F: Port-Orford-Cedar Root Disease Risk Assessment

PROJECT DESCRIPTION

The Six Rivers National Forest proposes to manage vegetation and hazardous fuels on approximately 2,749 acres of conifer/hardwood stands and a meadow through commercial timber harvesting, timber stand improvement, and fuel reduction treatments. The project would take place on National Forest System lands administered by the Smith River National Recreation Area (NRA) in Del Norte County, California. The proposed project area is located south of the community of Gasquet, along the French Hill area and northwest of the community of Big Flat. It is accessed by county roads 405 and 411. It drains into the Lower Middle Fork Smith River, Craigs Creek, Coon Creek, Gordon Creek, Canthook Creek and Hurdygurdy Creek. The planning area occurs in portions of the following: Township 17 North, Range 1 East, Section 25; Range 2 East, Section 25, 26, 29, 31, 32, 33, 34, 35, 36; Range 3 East, Sections 30, 31, 32; Township 16 North, Range 2 East, Section 1, 2, 5, 6, 7, 8, 11, 12, 13, 14, 15, 17, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36; Range 3 East, Sections 5, 7, 8, 18, 19, 30, 31; and Township 15 North, Range 2 East; Sections 1, 2, 11, 12, & 14 of the Humboldt Meridian.

Currently approximately 52% of the mapped POC populations are known to be infested in the project area. This is primarily due to the fact that the area is accessed year round by county roads, which have no mitigation measures for restriction disease spread. The county roads access the upper reaches many of the streams that have POC within them. All treatment units were evaluated for the presence of Port-Orford-cedar (POC) in or adjacent to the unit. Mitigations measures were applied where possible. In cases where it was not possible to mitigate the impacts to POC, the units were dropped.

MANAGEMENT DIRECTION FOR PORT-ORFORD-CEDAR

Management direction for POC is from the Six Rivers National Forest Land and Resource Management Plan, Forest Management Direction (Chapter IV, page 129), Standards and Guidelines (S&Gs) 20-6 to 20-10. In summary the S&Gs address:

1) Management of POC as a long-term component of plant associations where present.

2) Integration of POC root disease (*Phytophthora lateralis*) control strategies for reducing the risk into environmental analyses and project planning.

3) Practices applied on a site or drainage specific basis to prevent or, if the disease is present, reduce the spread and severity of POC root disease.

4) Public information and education concerning POC root disease and reducing the spread.

MANAGEMENT OBJECTIVES

1) Prevent the import of disease into uninfected areas (off site spores picked up and carried into uninfected project area).

2) Prevent the export of disease from infected areas (on site spores moved to off-site uninfected area).

3) Minimize the rate of spread in areas where the disease already occurs.

To reduce the risk of introducing Port-Orford-cedar root disease into the project area, the following would be implemented:

1. Limit road reconstruction and decommissioning to the dry season only.
2. Limit operating season of the timber sale to the drier months. No operations may occur between October 15th and May 15th without written approval by the Forest Service.
3. No surface maintenance on gravel roads would occur when road conditions are wet (such as during or immediately after rainfall).
4. Wash mud and dirt from earth moving, yarding, loading, and other support equipment prior to beginning work on the project site and following completion of work.
5. Equipment must be washed before entering the project area or leaving the area at a place approved by the Forest Service.
6. Constrain timber haul and purchaser vehicle access so that vehicles do not travel from an infected to un-infected area.
7. Avoid using water for dust abatement that may be potentially infected with root disease. If a potentially infected water source must be used, treat with Clorox brand chlorine bleach before application (1 gallon of Clorox per 1000 gallons of water). Use chlorinated water to wash all vehicles and heavy equipment.

RISK ASSESSMENT

The risk of POC infection from *Phytophthora lateralis* and the spread of this disease is closely associated with three variables that were used for a risk assessment. These are the distance POC is from water, the distance to the nearest road and the distance of the nearest infestation. Other factors are important too, such as road composition. Native dirt roads have a much higher risk of infecting POC stands than paved roads have. In the project area, most of the roads are not paved.

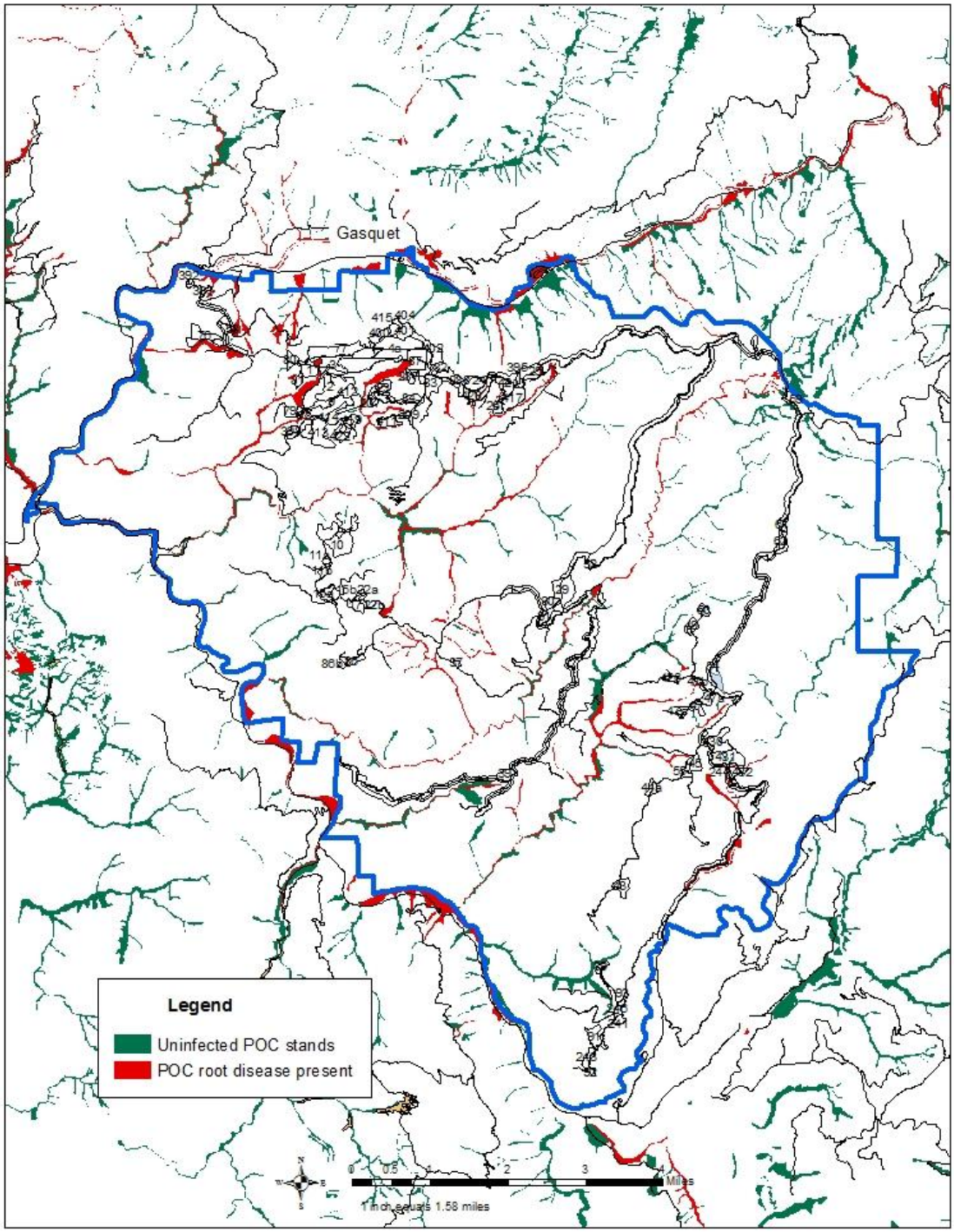
RISK ASSESSMENT MATRIX

PROXIMITY OF POC TO ROADS (HAZARD)		
LOW	MODERATE	HIGH
>500 ft below	>100-500 ft below	<100 ft below
>50 ft above	>50 ft above	<50 ft above
> 500 ft from water	100 ft – 500 ft from water	< 100 ft from water

NARRATIVE ASSESSMENT OF RISK

The project area contains POC, with the majority of located within riparian zones. Most portions of all the creeks within the project area contain infested stands of POC (see map). Due to the proximity of POC to roads in the project area, the risk to further import, export, or spread the POC root disease is medium to high without POC root disease control prescriptions. The risk for this area can be reduced to low by implementation of the prescriptions of the control strategy.

The roads to be used during the sale have native surface, or native surface with small areas of rock. Such roads would increase the risk without using control prescriptions.



July 29, 2014

Figure 2. Current Known Locations of Port-Orford-Cedar Plant Associations

DISEASE CONTROL PRESCRIPTIONS

The Gordon Hill Vegetation and Fuel Management Project would utilize Del Norte County Roads 405 and 411. Both roads are gravel, and when used in the dry season would not add risk of POC root disease spread during the duration of the project. There is no control over the County roads at this time. Del Norte County is responsible for maintenance and condition.

National Forest System roads that would be used during the project by geographic area include:

- County road 411, French Hill area: 17N25, 17N26, 17N41, 17N41A, 17N41G, 17N41H, 17N48, 17N40, 17N40B, 17N40C, 17N40D, 17N14, 17N46, 17N37, 17N13, 17N16, 17N39 and 17N39B
- Lower Coon Mountain: 17N07, 17N07G, 17N07Q, 16N19 and 17N36
- County road 405, Gordon Mountain area: 16N41, 16N41C, 16N37, 16N37B, 16N38, 16N21 and 16N21F
- Hardin Mountain area: 15N11 and 15N11A

A variety of control prescriptions would be utilized on this project. Education of the public may be enhanced by the distribution of POC information pamphlets and flyers at the pre-work meeting with contractors. Emphasis on the POC root disease and its impact on activities to all employees may be beneficial. The following are control prescriptions to be used:

Roads and Equipment

1. Temporary road locations will avoid POC.
2. Limit road and landing construction to dry season only.
3. Wash (high pressure or steam clean) all equipment prior to entering project area.
4. Operate in non-infected areas first, if possible. If moving from infested to non-infested area, all vehicles and equipment shall be high pressure or steam cleaned before entering non-infested area. (C6.342 – Cleaning of equipment; C6.343 – Post operation cleaning of equipment).
5. All temporary roads will be closed after use (outsloped, ripped, and waterbarred).
6. All water used for dust abatement will be obtained from an uninfected water source (as determined by the Forest Service).
7. Limit timber hauling to dry season only. The dry season occurs from approximately June 1 to October 15, depending on weather conditions. Operations may be shut down during this season if wet weather occurs.
8. Limit road maintenance activities to dry season only.

Timber Harvest

1. Limit timber sale activities requiring vehicle or equipment access to dry season only. The dry season occurs from approximately June 1 to October 15, depending on weather conditions. Operations may be shut down during this season if wet weather occurs.
2. Limit activity in riparian reserves to dry seasons.
3. Wash all equipment and vehicles before entering the project area (high pressure/steam clean).
4. Wash all equipment and vehicles prior to leaving infested sites and moving to non-infested sites.
5. Work in non-infected sites first, if possible, to reduce risk.

COST EFFECTIVENESS ESTIMATE

The effectiveness of the mitigations should be high if enforced. If the timber sale activities are restricted to the dry season, risk is **LOW** for spread. The overall cost of implementation is low due to the continued monitoring of activities for adherence to contract specifications. Forest Service costs are related to information pamphlets, flyers, and inserts explaining the POC and the root disease.

POTENTIAL IMPACT ANALYSIS

A. Following mitigation, is *Phytophthora lateralis* likely to spread into uninfested stands within a major amount of the analysis area? (Ref. CEQ Reg. 1508.27) If no, then no secondary or cumulative effect expected. If YES, continue. **NO**

B. Will the potential secondary and cumulative effects cause meaningful levels of mortality? **NO**

Definitions:

Major amounts of analysis area: great or large in relative importance to POC existence in the near proximity and over its range. Effects are notable or conspicuous in effect or scope (e.g. visually detracting); or posing a serious risk to the ecosystem, adjacent POC, or the total population.

Meaningful levels of mortality: a mortality rate of 25% or more of existing POC over the next 20-year period.

POTENTIAL IMPACT NARRATIVE

The use of Del Norte County Roads 405 and 411 and National Forest System roads (listed above) for access to all work sites during operations may increase the risk of spreading *Phytophthora lateralis*, but only slightly. This is because the spread of the disease by vehicles is primarily during wet ground conditions, and operations will occur during dry weather conditions when the ground is drier. The other mitigations described

above for Forest Service roads and stand level operations would reduce the risk level to a **LOW** category of infecting any significant amount of POC along any of the access routes utilized. Current locations of the infections would remain static with individuals and small groups around centers continuing to be affected. The distances between locations of POC reduce the opportunity for spread along all routes.

MONITORING

The current Forest Service policy is to monitor locations of infections and to constantly update any new locations. Spread from infection centers are noted and new centers are recorded and updated for use in risk assessments conducted on future projects.