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Draft Environmental Impact Statement

Beaverslide Timber Sale and Fuel Treatment Project

Mad River Ranger District, Six Rivers National Forest
Trinity County, California

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Beaverslide Timber Sale and Fuel Treatment Project
Draft Environmental Impact Statement
Trinity County, California

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Abstract: The Six Rivers National Forest is proposing to harvest commercial timber and treat hazardous fuels on National Forest System (NFS) lands administered by the Mad River Ranger District. The Beaverslide Timber Sale and Fuel Treatment Project area is located in the Upper Mad River watershed, near the town of Ruth, California. The proposed action is intended to implement commodity output goals and management direction contained in the Six Rivers National Forest Land and Resource Management Plan (LRMP).

This draft environmental impact statement (DEIS) describes four alternatives, including the modified proposed action and no action, which represent different project designs intended to address resource issues raised by the public while meeting the purpose and need. In addition to displaying alternatives, this draft statement discusses the estimated effects of implementing each of the alternatives and compares the alternatives in terms of meeting management objectives and estimated impacts to resource values at issue, based on comments received from the public pursuant to the project scoping process.

It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the final EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

The opportunity to comment ends 45 days following publication of the notice of availability (NOA) in the Federal Register.

Send Comments to: Thomas Hudson, Mad River Ranger District, 741 State Highway 36, Bridgeville, CA 95526.

Date Comments Must Be Received: August 4, 2009

Summary

The Six Rivers National Forest proposes to harvest commercial timber from the Beaverslide Timber Sale and Fuel Treatment Project. The area affected by the proposal includes conifer stands located in the southern portion of the Upper Mad River watershed. This action is needed because Ruth, California is currently at risk to wildfires due to dense forest conditions and there is an opportunity to provide timber commodities that contribute toward a sustainable, predictable, long-term timber supply for local economies.

A number of stands in the Beaverslide Timber Sale and Fuel Treatment project area were identified as needing treatment to achieve commodity output goals and to move them towards the desired vegetation condition described in the Six Rivers National Forest Land and Resource Management Plan (LRMP). Specialists in a wide array of disciplines visited these sites and worked together to develop a timber sale project proposal consistent with all LRMP standards and guidelines. Many of the preliminary treatment units were not included in the final proposal due to various resource and economic concerns.

A variety of efforts was made to involve the public. Notices were placed in the Six Rivers National Forest Schedule of Proposed Actions. The United States Fish and Wildlife Service and the North Coast Water Quality Control Board were consulted early in the planning process. A detailed description of the proposal has been submitted to affected and interested citizens, organizations, agencies, and Native American tribes twice, once on October 2, 2008 and again on December 18, 2008. A notice of intent to prepare an EIS was published in the Federal Register on December 17, 2008. Sixteen individuals, agencies, or organizations responded during the two scoping periods.

Numerous concerns were raised by the public. Examples include concerns about air quality, watershed and soils, sensitive plant and animal species, economics, fire risk, and noxious weeds. Additional alternatives were created to address the following significant issues:

- Without regeneration harvest, the purpose and need of providing a sustainable predictable, long-term timber supply for local economies may not be met.
- Road construction, reconstruction, and existing road conditions may contribute to increased sediment that would not meet the TMDL[1] requirements for sediment and turbidity that is allowed for the Mad River.

These significant issues, plus new information acquired concerning the northern spotted owl following scoping, led the agency to modify the original proposed action and develop two new alternatives to the proposed action as follows:

- No action, which would preclude timber harvesting and connected actions at this time.
- A proposal that is similar to the original proposed action but one that includes a limited amount of regeneration cutting with green tree legacy. Through project

[1] Total maximum daily load – a standard established by EPA and the State of California. See p. 128

design, all regeneration units were situated in areas with limited or no impact to other resources.

- A proposal that is similar to the original proposed action but one that increases the use of helicopter logging as a logging system to avoid creating any new temporary roads.
- A proposal that is a modification of the original proposed action that reduces the impact to the northern spotted owl by reducing the amount of roads and treated acres within one territory.

The project area lies within the Mad River Watershed, which as been listed as water quality impaired. Under all action alternatives, there is a low likelihood of impacting soil productivity and water quality, given the design of the project, use of best management practices and avoidance of ground-disturbing activities or vegetation manipulation in the lower half of the riparian reserves. The primary sources of sediment have been identified as the current road conditions. Under all action alternatives, over 8 miles of roads that were identified as the primary sources of sediment will be rehabilitated and decommissioned.

The project area lies outside of managed northern spotted owl conservation areas. Existing older and more structurally complex multi-layered conifer forest within the matrix between the conservation areas will be maintained under all action alternatives.

Long-term beneficial effects to vegetation would accompany any short-term adverse effects. Well-stocked, vigorous stands would be established for the long term. The action alternatives would provide timber products to benefit consumers in the short-term. There would be an increase in stand vigor, a reduction in fuel hazard within the stands, and a corresponding decrease in the risk of stand-replacing fire occurring within the harvest units.

Short-term negative effects include a 1- to 2-year increase in fuel hazard in the harvested stands prior to fuel treatment, and a reduction in visibility and smoke during the short periods when prescribed burning occurs. There may be limited noise and smoke disturbance to northern spotted owls due to burning. There would also be some minor effects to wildlife species.

The cumulative effects of implementing the action alternatives, in conjunction with other management activities at various scales, would not lead to significant losses in suitable habitat for late-successional wildlife species across the watershed. These cumulative effects would result in minimal effects on individuals and not lead to losses in viability of populations.

The cumulative effects of implementing the action alternatives, when combined with other actions in the assessment area, would not remove any old growth vegetation, would have negligible effects on the beneficial uses of water, and would have a minimal effect on the habitat of other wildlife species. There would be beneficial cumulative effects to wildlife habitat by reducing stand-stocking levels.

The action alternatives, as designed, would be consistent with all environmental laws. Based upon consideration of the estimated effects, the responsible official will decide whether the proposed action would proceed as proposed, or as modified by an alternative.

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Chapter 1. Purpose of and Need for Action

Document Structure

The Forest Service has prepared this environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

- **Chapter 1. Purpose and Need for Action:** This chapter briefly describes the proposed action, the need for that action, and other purposes to be achieved by the proposal. This section also details how the Forest Service informed the public of the proposed action and how the public responded.
- **Chapter 2. Alternatives, including the Proposed Action:** This chapter provides a detailed description of the agency's proposed action as well as alternative actions that were developed in response to comments raised by the public during scoping. The end of the chapter includes a summary table comparing the proposed action and alternatives with respect to their environmental impacts.
- **Chapter 3. Affected Environment and Environmental Consequences:** This chapter describes the environmental impacts of the proposed action and alternatives.
- **Chapter 4. Consultation and Coordination:** This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.
- **Appendices:** The appendices provide more detailed information to support the analyses presented in the environmental impact statement.
- **Index:** The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at Mad River Ranger District, 741 State Highway 36, Bridgeville, CA 95526.

Background

The Beaverslide Timber Sale and Fuel Treatment Project (Beaverslide Project) project area is approximately 13,241 acres in size and is located south of Ruth, California (Figure 1). The project area is located on National Forest System lands administered by the Mad River Ranger District in Trinity County, California, and is located in portions of the following legal location: T. 2 S., R. 7 E.; T. 2 S., R. 8. E.; T. 3 S., R. 7 E.; T. 3 S., R. 8 E., Humboldt Baseline and Meridian, and T. 26 N., R. 12 W.; T. 27 N., R. 12 W., Mount Diablo Baseline and Meridian.

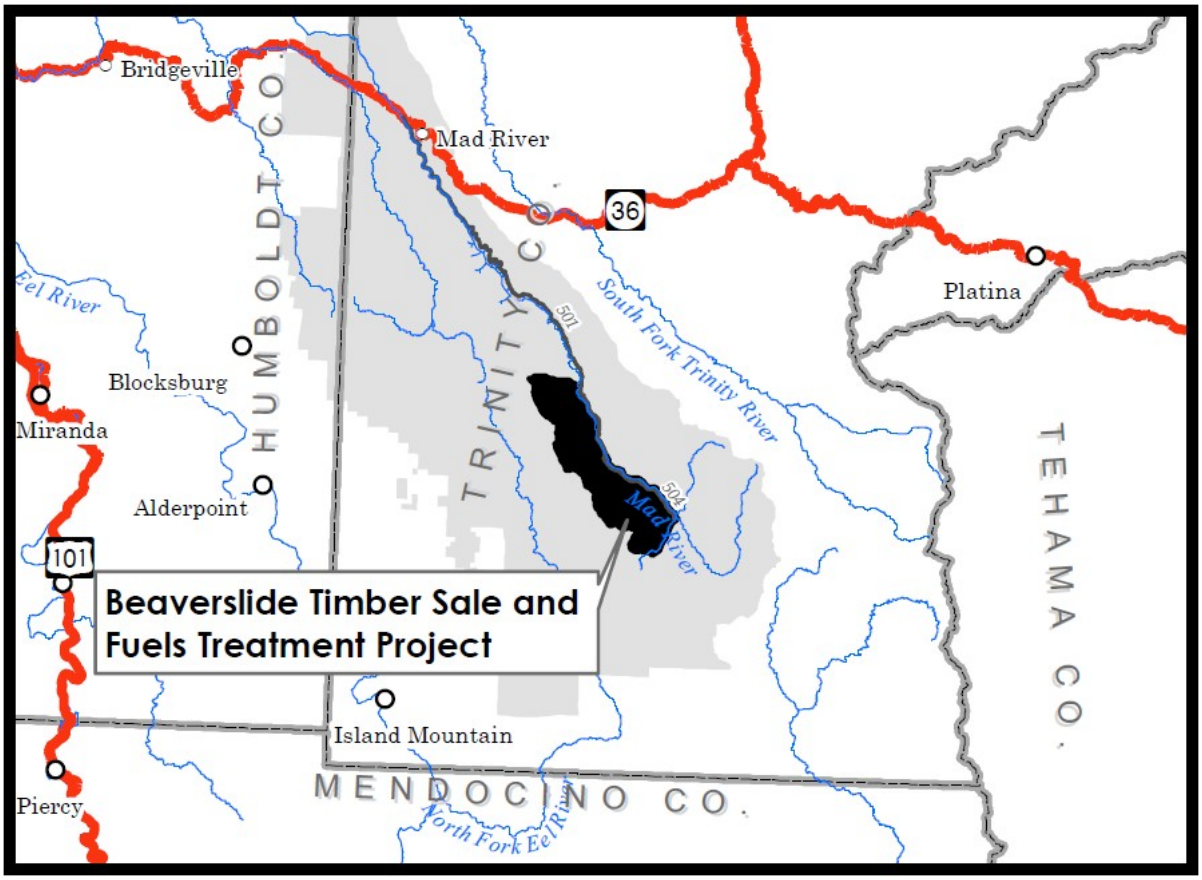

Figure 1. Location of the Beaverslide Timber Sale and Fuel Treatment Project

The Beaverslide Project is designed to contribute timber commodity outputs in support of the Six Rivers Forest National Forest Land and Resource Management Plan (LRMP). One of the goals of the LRMP is to provide a stable supply of outputs and services that contribute to local, regional, and national social and economic needs. The Six Rivers National Forest seeks to provide a sustainable, predictable, long-term timber supply for local economies (LRMP, p. II-2).

The project area also occurs within the wildland-urban interface for communities in the vicinity of Ruth, California. In 2005, the Trinity County Fire Safe Council completed a Community Wildfire Protection Plan to address the fire risk surrounding these communities. Several homes and businesses in the area are within the wildland-urban interface. The project is designed to reduce fire hazard and risk to the community.

The project area lies within the Upper Mad River Watershed, which has been listed as water-quality impaired under Section 303(d) of the Federal Clean Water Act for sediment and turbidity. A report for total maximum daily loads (TMDL) for sediment and turbidity was completed by the Environmental Protection Agency (EPA) in December of 2007, recommending a reduction of sediment inputs from current levels.

Three Forest Service sensitive species (one wildlife and two botanical), one federally listed wildlife species, and two Forest Service survey-and-manage botanical species are known to occur in the project area. Habitat also exists for three additional Forest Service sensitive wildlife species.

Purpose and Need for Action

One of the goals of the Six Rivers National Forest LRMP is to provide a stable supply of outputs and services that contribute to local, regional, and national social and economic needs. The Six Rivers National Forest seeks to provide a sustainable, predictable, long-term timber supply for local economies. The Forest's allowable sale quantity (ASQ) from matrix lands is an average of 15.5 million board feet (MMBF) per year (LRMP, p. II-2).

As such, there is a need for the Six Rivers National Forest to provide timber volume to contribute to the economic base of local communities. The LRMP allocates the project area to general forest, partial retention visual quality objective, and retention visual quality objective (LRMP, pp. IV-56, IV-62 to 64) management areas. These management areas are a subset of the matrix landbase allocated under the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994), and as such provide for programmed timber harvesting. The opportunity exists for the project area to contribute volume towards the Forest's ASQ at this time (LRMP, p. IV-6).

Communities in the vicinity of Ruth, California are currently at risk to wildfires due to the dense forest sites that occur within the wildland-urban interface. The Trinity County Fire Safe Council found that fuel hazards are moderate but fire risk relative to human safety and property is high due to the number of people in the area.

Given Forest goals and environmental conditions within the project area, the purpose and need for the proposed action is to:

- Provide timber commodities that contribute towards the Forest's goal to provide a sustainable, predictable, long-term timber supply for local economies; and
- Reduce fuel loading in strategic locations and strategically locate fuel treatment corridors to improve fire protection and human safety around communities in the vicinity of Ruth, California.

Within the context of meeting the purpose and need, there would be opportunities for fuelwood or biomass utilization associated with proposed activities.

Proposed Action

The action proposed by the Forest Service to meet the purpose and need was to manage vegetation on approximately 4,780 acres through commercial timber harvest and fuel reduction treatments across the Beaverslide project area.

Commercial timber harvest would occur on approximately 2,471 acres utilizing a thinning prescription. Actions connected to commercial harvest include treatment of harvest-activity-generated fuel; construction of new temporary roads, and reutilization of existing temporary roads; construction of new landings and reutilization of existing landings; hauling of commercial timber products on National Forest System (NFS) roads; and road maintenance activities along haul routes.

Fuel reduction would occur on approximately 2,309 acres using one or more of the following treatments: thinning or pruning understory vegetation; lopping and scattering of existing ground fuel and thinning/pruning residue; hand or machine piling; pile burning; roadside chipping; mastication; and jackpot burning.

Upon completion of commercial harvest and fuel reduction treatments, 7.4 miles of National Forest System roads would be decommissioned, and 0.87 mile of unauthorized roads and 8.2 miles of temporary roads would be closed.

Decision Framework

Given the purpose and need, the Forest Supervisor as the deciding official will review the proposed action, the other alternatives, and the environmental consequences to make one of the following decisions:

- Select the proposed action;
- Select an action alternative that has been considered in detail;
- Select a modified version of the proposed action or an action alternative; or
- Select the no action alternative

Land and Resource Management Plan Direction

National Forest management is guided by various laws, regulations, and policies that provide the framework for all levels of planning. This includes Regional Guides, Forest Plans, and site-specific planning documents such as this environmental impact statement. These higher-level documents are incorporated by reference and can be obtained from Forest Service offices. Relevant laws, regulations, and policies in addition to Forest Plan direction are also referenced in individual specialist reports that are part of the project record.

This project would implement direction found within the Six Rivers LRMP, published in June 1995. The LRMP for Six Rivers National Forest incorporates standards and guidelines (S&Gs) from the *Record of Decision for Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl*--also referred to as the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994).

The project would be consistent with the January 9th, 2006 court order, NEA et al. vs. Rey et al., Civ. No. 04-844P), ground-disturbing activities need to comply or demonstrate consistency with the 2001 Record of Decision (ROD) and Standard and Guidelines for Survey and Manage Species (USDA and USDI 2001), as stipulated in Memorandum 2670 (FS)/ 6840 (BLM) (OR-931) P, dated February 22, 2006, in reference to Management Direction regarding the January 9, 2006 Order on the Plaintiffs' Motion for Injunctive Relief, NEA et al. v. Rey, et al, Civ. No. 04-844P, W.Dl Washington.”

Compliance or consistency with the 2001 ROD, as updated by the 2003 Annual Species Review (ASR), includes application of existing recommendations to management of any known

sites of survey-and-manage species potentially affected by project activities and pre-disturbance surveys for those species listed as Category A or C (USDA and USDI 2001).

This draft environmental impact statement (DEIS) was prepared under the direction of the 2004 Aquatic Conservation Strategy (ACS). The ACS ROD clarified the proper spatial and temporal scale for evaluating progress toward attainment of ACS objectives and stated that no project-level finding of consistency with the ACS objectives was required. Land managers would be required to demonstrate that projects comply with applicable standards and guidelines, such as riparian buffer widths, and to document how applicable watershed analysis was used to provide context for project planning. The DEIS follows this direction.

On March 30, 2007, a final judgment was rendered by Judge Martinez on *Pacific Coast Federation of Fishermen's Associations, et al. v. National Marine Fisheries Service* (#C04-1299RSM) in the Western Washington District of the U.S. District Court that set aside the 2004 ACS ROD with its clarifying provisions. Based on that decision, this DEIS includes discussion in Chapter 3 on how the Beaverslide Project is consistent with the ACS (see p. 143).

The following is a summary of the LRMP management direction applicable to the project, relative to management areas and Forestwide program management and resource protection:

Management Area 8 – Special Habitat: Special habitat within the project area consists of two 100-acre late-successional reserves (LSRs). This management area is intended to provide a core of relatively undisturbed habitat for plants and animals associated with mature and old-growth forests. The management emphasis and goal is to protect and enhance late-successional habitat (LRMP, pp. IV-34, 35).

Management Area 9 – Riparian Reserves: This management area encompasses land within a prescribed distance of streams and waterbodies. Under the Aquatic Conservation Strategy, riparian reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and -associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed. The riparian reserves also serve as connectivity corridors among the late-successional reserves (LRMP p. IV-45).

Management Area 13 – Retention Visual Quality Objective: These areas are typically within the foreground of state highways and other highly sensitive viewing locations such as county roads, streams, or trails. In the case of this project area, the retention areas represent foreground areas as seen from County Road 504, and portions of NFS roads 2S12 and 3S13 along the Forest's segment of the California Back Country Discovery Trail.

The overall character of the landscape in a retention area may change over time, but individual and cumulative project effects should not dominate the areas mapped as retention. The primary goals within this management area are to maintain the area in a natural-appearing condition; to provide an attractive, forested landscape where management activities remain non-evident to the casual Forest visitor; and to manage for a programmed, sustained harvest of forest products in areas that are timber-suited (LRMP, p. IV-56).

Management Area 16 – Partial Retention Visual Quality Objective: These areas are typically middle-ground and background viewing areas as seen from highly sensitive viewing areas, or are foreground areas as seen from moderately sensitive viewing locations such as county roads, streams, or trails. In the case of this project area, the partial retention areas represent foreground areas as seen from County Road 504, and portions of NFS roads 2S12 and 3S13 along the Forest's segment of the California Back Country Discovery Trail.

The overall character of the landscape in a partial retention area may change over time, but individual and cumulative project effects should not dominate the areas mapped as partial retention. The primary goals within this management area are to maintain the area in a near-natural-appearing condition; to provide an attractive, forested landscape where management activities remain visually subordinate to the character of the landscape; and to manage for a programmed, sustained harvest of forest products in areas that are timber-suited (LRMP, p. IV-62).

Management Area 17 – General Forest: 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 (LRMP, p. IV-63). The majority of the project area falls within this management area designation.

Vegetation Management: Vegetation management on the Forest focuses on achieving an ecologically balanced distribution of vegetation series and seral stages over time. The amount and types of disturbances that occur within the Forest influence stand composition and the distribution of seral stages. During the development of the LRMP, the historic range of variability (HRV) was calculated for each vegetation series and seral stage. The HRV represents the range of vegetation conditions that have existed on the Forest over the last 200 years due to disturbance and succession. The vegetation management objective in the LRMP is to manage within a subset of the HRV for each vegetation type and seral stage; this subset is called the recommended management range (RMR). Managing vegetation to achieve the recommended management range for each vegetation type and seral stage is intended to ensure healthy forest ecosystems that maintain ecological processes and functions. Harvest prescriptions are to be used to create a seral stage distribution within the recommended management ranges. Stand regeneration may be used where current conditions are in excess of the recommended management range. Intermediate harvesting and uneven age prescriptions may be implemented to accelerate stand growth from one seral stage to another, or to increase diversity within individual stands (LRMP, p. IV-78, S&G 4-4).

LRMP direction is to manage vegetation to be within the recommended management range for each vegetation series on a landscape scale (LRMP, p. IV-74). In order to evaluate the distribution of vegetation series and seral stages at the landscape level, the Forest is divided into three recommended management range zones. These zones are based on similar disturbance

regimes, and vegetation within each zone has been assessed to be ecologically similar or connected. The south zone (230,810 acres) includes National Forest System lands south of Whiting and Last Chance Ridge to the southern boundary of the Six Rivers National Forest. The Beaverslide project area is located at the southern end of the southern zone.

Vegetation management on lands suited for timber production within the management areas where programmed harvest occurs is driven by goals that include the production of commercial yields of wood, the retention of ecologically valuable old-growth components such as snags, logs, and large green trees, and increasing ecological diversity by providing early-successional habitat subject to the recommended management range guidelines described above (LRMP, p. IV-75).

Watershed Management: The project area is located entirely within the Upper Mad River watershed, which is designated as a non-key watershed under the LRMP. The designation is based on the lack of anadromous fish occurrence above Matthews Dam. Interim widths for riparian reserves necessary to meet Aquatic Conservation Strategy objectives for different water-bodies are established based on ecologic and geomorphic factors. These widths are designed to provide a high level of fish habitat and riparian protection until watershed analysis can be completed. In the establishment of widths for the interim riparian reserves, it was found that using the distance of one site-potential tree height would be effective to remove sediment in most situations (FEMAT 1993). A watershed analysis was completed for Upper Mad River in January 1998. No changes to the interim riparian reserve widths were made for this project.

Forestwide Resource Protection: Other LRMP management direction that is tied to the protection of natural resources includes standards and guidelines that set restrictions on management activities and establish thresholds of acceptability that govern project design. For this project, the following LRMP standards and guidelines would apply: Geology, Soil, and Watershed Management (p. IV-70), Air Quality (p. IV-72), Biological Diversity (p. IV-73), Native Plant Material Use (p. IV-81), Sensitive Plant Species (p. IV-83), Survey and Manage Species (p. IV-84 as amended), Wildlife Resource Management (p. V-96), Heritage Resources (p. IV-114), Transportation and Facilities Management (p. IV-115), Fire and Fuels Management (Goals, p. IV-116, Standards and Guides, pp. IV-1 to IV-131), Pest Management (p. I-129), and Visual Quality (p. IV-131).

Public Involvement

Scoping as defined by the Council on Environmental Quality (CEQ) includes refining the proposed action, identifying preliminary issues, and identifying interested and affected persons. Public scoping was first initiated October 2, 2008. Based on the complexity of the project, it was decided that the analysis would be done using an environmental impact statement (EIS). A notice of intent (NOI) to prepare an EIS was published in the Federal Register on December 17, 2008. Additional comments were solicited December 18, 2008.

Public scoping consisted of mailing a letter to 14 organizations, 10 Federal, State, or local agencies, 44 individuals, and 1 Native American Tribe, all of whom have shown interest in Mad

River Ranger District projects in the past. The letters explained the purpose and need for the project, provided maps of the project, and solicited comments on the proposed action. Sixteen comment letters or phone calls were received as a result. Copies of the letters and documentation of phone conservations can be found in the analysis file.

The Beaverslide Project was listed in the Six Rivers National Forest's Schedule of Proposed Action (SOPA) starting in the Summer Quarter of 2007. The SOPA is mailed out to a Forest mailing list of people interested in the management activities of the Forest. The SOPA provides one of the means of keeping the public informed of the progress of individual projects. The SOPA is also made available to the public on the Six Rivers National Forest website.

Additional information on public involvement can be found in the Chapter 4 section of this document, Consultation and Coordination. Copies of these various documents and their attached mailing lists can be found in the analysis file.

Issues

Scoping and public involvement activities are used to identify unresolved issues about the effects of the proposed action. The public involvement process leads to determining the scope of issues to be addressed and for identifying the **significant** issues related to the proposed action. By deemphasizing insignificant issues, the scope of the environmental impact statement (EIS) can be narrowed (40 CFR 1501.1(d)). The Council on Environmental Quality (CEQ) NEPA regulations provide guidance to identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (40 CFR 1506.3). Non-significant issues are those concerns that are:

- Already decided by law, regulation, LRMP, or other higher level decision;
- Addressed through implementation of LRMP standards and guidelines and best management practices;
- Addressed through implementation of project-specific mitigation measures;
- Addressed during the processes or analyses routinely conducted by the interdisciplinary team (IDT);
- Irrelevant to the decision to be made;
- Conjectural and not supported by scientific or factual evidence; or
- Outside the scope of the proposed action.

Significant issues are used to develop a full range of alternatives to the proposed action that meet the identified purpose and need. By deemphasizing nonsignificant issues, the size and complexity of the analysis is more manageable. From all of the comments received, the Forest Service identified the following issues, drafted into issue cause-and-effect statements.

1. Without regeneration harvest, the purpose and need of providing a sustainable, predictable, long-term timber supply for local economies may not be met.

a. The primary goals for Management Area 17 are to produce a sustained yield of timber and contribute younger seral stages to the overall vegetation mosaic of the forest. Timber harvest has failed to meet the predicted ASQ. Having younger age classes is important in maintaining the recommended management ranges of age classes within the various vegetation series to maintain a predictable, long-term timber supply for local economies. The LRMP estimated that 360 acres annually or 3,600 acres of regeneration harvest with legacy retention would be needed each decade to achieve desired forest conditions. During the last 10 years, there has only been approximately 550 acres of regeneration harvest. The evaluation criteria for this issue are as follows:
    i. Acres treated
    ii. Timber volume
    iii. Acres regenerated

2. Road construction and reconstruction may contribute to increased sediment loading in a watershed that is listed as water quality impaired for sediment and turbidity under the Federal Clean Water Act.
    a. Commercial thinning and associated road management activities may affect water quality and the aquatic habitat. Timber harvest and roads interact and influence the production of sediments. Roads can intercept subsurface flow and route the flow more quickly to adjacent stream channels potentially increasing peak flows. This issue was determined to be significant because project area lies within the Upper Mad River Watershed, which has been listed as water quality impaired under Section 303(d) of the Federal Clean Water Act for sediment and turbidity. The Mad River TMDL calculates needed reductions in total and suspended sediment are 26 percent for the Upper Mad subarea, which is comparable to the Upper Mad River 5th-field watershed. Most of the sediment production is from roads; the EPA analysis showed 62 percent of sediment production basinwide was from roads, 2 percent was from timber sales and 36 percent was from natural causes (U.S. EPA 2007).The evaluation criteria for this issue are as follows:
        i. Miles of unpaved NFS roads utilized for timber hauling
        ii. Miles of NFS roads maintained or improved
        iii. Miles of temporary road construction
        iv. Miles of NFS roads decommissioned and removed from the transportation system
        v. Miles of temporary roads decommissioned
        vi. Miles of unauthorized routes on NFS lands decommissioned

Chapter 2. Alternatives

Introduction

This chapter describes and compares the alternatives considered for the Beaverslide Timber Sale and Fuel Treatment Project. Chapter 2 is intended to present the alternatives in comparative form, defining the concerns and providing a clear basis for choice among options by the responsible official and the public (40 CFR 1502.14). Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., helicopter logging versus the use of temporary roads) and some of the information is summarized from Chapter 3, “Environmental Consequences.” Chapter 3 contains the detailed scientific basis for establishing baselines and measuring the potential environmental consequences of each of the alternatives.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative themes for consideration in this environmental analysis. Some of these alternatives may have been outside the scope of meeting the need to provide timber to support the economic base of the local communities, duplicative of the alternatives considered in detail, or determined to be economically non-viable due to higher cost/benefit ratios and lack of positive value opportunities outside of the immediate project area. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

The following alternative themes and designs were considered but not carried forward:

- The proposed action (Alternative 2) as reviewed by the public during the scoping process will be dropped from further consideration because of new information obtained and the need to make modifications to protect the northern spotted owl. The proposed action was modified based on new information obtained as a result of consultation proceedings with the U.S. Fish and Wildlife Service under the Endangered Species Act and is now carried forward as Alternative 5.
- An alternative that concentrates on thinning small-diameter fire suppressed stands and not include large-diameter logging was proposed as part of a public comment but failed to define exactly what “large-diameter logging” is but it is assumed that the commenter proposed that there be no “commercial logging”. Tree densities within stands proposed for thinning are all over-stocked and do not meet the desired conditions for a healthy forest. As trees put on more growth, they will grow even denser, further exasperating the

problem. No thinning of commercial-size trees will not meet the purpose and need of providing a sustainable, predictable, long-term supply of local economies and will not reduce fuel loading necessary to improve fire protection and provide human safety and will not be carried forward for further detailed analysis.

Alternatives Considered in Detail

This section describes the alternatives considered by the Forest Service for the Beaverslide Project. This section includes a summary of alternatives developed followed by, a description of connected actions associated with the action alternatives, and project design features that include mitigation and monitoring provisions. Maps and unit summaries of the action alternatives are found in Appendix A and C of this document. Finally, a comparison of the alternatives is provided.

A project area was identified and information on existing resource conditions were either collected or pulled together from existing data sources to be compared with the desired condition as described by the Six Rivers National Forest LRMP. Based on the comparison between the existing and desired conditions, a purpose and need for management treatments was articulated. An interdisciplinary team (IDT) was formed to identify site-specific management opportunities used to prepare a proposed action that would meet the purpose and need while protecting the biological and physical resources.

Locations and the types of treatments proposed were based on the various management plans that are included in or encompassed by the Six Rivers LRMP. Selecting what areas to treat was based on a coarse/fine filter approach where the initial selection is based on stand structure and density and all units where stand conditions can be improved were selected. These areas were then refined based on the LRMP standards and guidelines and other incorporated management plans such as the newly released northern spotted owl recovery plan. Protection of wildlife species that depend on mature and old-growth habitats, such as the northern spotted owl, and protection of riparian corridors were the primary concerns that shaped where and how treatments occurred. As an example, approximately 500 acres of mature and old-growth forest, which was considered high quality northern spotted owl nesting and roosting habitat, were excluded from treatment.

Project design and mitigation measures were developed for each resource area and would be used to reduce, minimize, or eliminate impacts to various natural and human resources and ensure that the project complies with the resource protection standards and guidelines of the Six Rivers National Forest LRMP and all laws and regulations.

Alternative 1 – No Action

The CEQ regulations (40 CFR 1502.14d) require that a "no action" alternative be analyzed. This alternative represents the existing and projected future condition against which the other alternatives are compared.

Under the no action alternative, no commercial timber harvest or fuel reduction treatments would be implemented to accomplish project goals.

Alternative 3 – Regeneration Harvest

Alternative 3 was developed to address the need for providing a sustainable, predictable, long-term timber supply for local economies (see Issues Section, Chapter 1). In order to have a timber supply over time, a diversity of seral stages (including a shrub/forb seral stage) is required. To provide a diversity of seral stages, Alternative 3 proposes regeneration harvest with legacy-tree retention along with commercial thinning. Alternative 3 commercially thins fewer acres within riparian reserves than other alternatives (see Table 1 and Map 1 in the map packet).

Regeneration Harvest Treatment Specific to Alternative 3

Approximately 205 acres within 28 treatment units would receive a regeneration harvest with legacy trees treatment, which would be followed by tree planting (see Table 67, Appendix A). Stands selected to receive regeneration treatments are even-aged stands that may be either understocked or overstocked. Some of the understocked stands have been selectively harvested in the past and are not growing at optimum rates. Overstocked stands have too many trees per acre and growth is declining. The majority of the trees in this type of stand typically have poor crowns due to inter-tree competition and are no longer growing to the stand's potential. Stands chosen for a regeneration harvest were in the mid-mature seral stage, or early-mature stands that were exhibiting poorer growth. The selection of these stands for regeneration was based on a need to be consistent with the LRMP guidelines and the Northern Spotted Owl Recovery Plan. No regeneration harvest would occur within riparian reserves. To be consistent with the Spotted Owl Recovery Plan, no northern spotted owl nesting or roosting habitat, late-mature, or old-growth stands would receive a regeneration harvest treatment, and no regeneration harvest would be located within the 0.7-mile radius home range core of northern spotted owl territories.

Regeneration harvest with legacy trees, also referred to as "green tree retention," is an even-aged silvicultural system designed to open up the stand sufficiently to provide for seedling establishment and growth while retaining on-site structures which provide a "legacy" of the previous stand. This legacy would provide structural diversity for the regenerated area. The following is a description of the regeneration harvest with legacy tree prescription in terms of trees that would be retained as part of the legacy:

- Existing vegetation would be left on 15 percent of the area associated with each cutting unit.
    - Generally, 70 percent of the area to be retained would be comprised of clumped legacy retention areas. To the extent possible, these legacy areas would represent the largest, oldest conifers in the stand and incorporate snags and down logs.
    - The remaining 30 percent of the area to be retained would have legacy trees dispersed as individual trees or small clusters of trees. An average of two to four trees

per acre would be retained outside of legacy retention areas. Distribution patterns would vary depending on factors such as incidence of disease, wind throw hazard, regeneration capability, and additional wildlife needs. To the extent possible, the largest oldest conifers would be retained.

- Retain young conifers currently existing in the stand to the extent possible.
- Retain hardwoods, particularly oaks, to the extent possible.

Reforestation would take place on all regeneration harvest units after logging and activity fuel treatments are completed. Units would be planted with approximately 400 trees per acre. The species planted would approximate the species composition of the unit prior to regeneration harvest. Manual release treatments to reduce competing vegetation and enhance seedling survival would occur where necessary. Manual release treatments may include mulching around seedlings during, or shortly after, planting to reduce grass competition, followed by grubbing or manually cutting brush two to four years after planting. No herbicides would be used to release conifer seedlings from competing vegetation.

Temporary Roads and Landings

The existing road system plus approximately, 5.3 miles of new temporary roads and 2.9 miles of existing non-system roads would be used to access ground-based and skyline treatment units (Table 1). Treatment units not accessible by road would be helicopter logged.

New temporary roads would be located and constructed to minimize ground disturbance, protect resources, and provide safe transportation at the least possible cost. Existing temporary roads are generally old jeep roads or temporary roads constructed for past harvest activities. These roads require re-opening and would require a road grader to restore the surface prior to use.

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

A total of 97 existing tractor, skyline, and helicopter landings would be used to the extent possible. Tractor and skyline landings are mostly within the roadbed. Three new helicopter landings may be constructed where necessary to facilitate logging operations. Existing and new landings would be located either within, or adjacent to, treatment units (see Map 5 in the map packet).

Alternative 4 – No Temporary Roads

Alternative 4 was developed to address issues concerning water quality (see Issues Section, Chapter 1). Under Alternative 4, no new temporary roads would be constructed. Without access provided by new temporary roads, a greater number of acres would be harvested using a

helicopter-logging system. Under Alternative 4, there would be no regeneration harvest. There would be a slight increase (89 acres) in the number of acres commercially thinned in the riparian reserves than Alternative 3. A total of 618 acres would be thinned within the outer half of the riparian reserve buffer. Total existing temporary roads used would be 1.7 miles (see Table 1, and Map 2 and Map 5 in the map packet).

Alternative 5 – Modified Proposed Action

Based on new biological information concerning the Northern spotted owl, Alternative 2 was dropped from further consideration and Alternative 5 was developed as a modification of the original proposed action (see “Alternatives Considered but Eliminated from Detailed Study” on page 10 and description of proposed action in Chapter 1, page 3). To minimize possible degradation of owl habitat, the number of acres treated and miles of new temporary road construction were reduced from what was originally proposed under Alternative 2. There would be no regeneration harvest. Alternative 5 would treat a total of 618 acres within the outer half of the riparian reserve buffer, which is the same as Alternative 4. Total temporary roads used would be the same as Alternative 3; therefore, there would be less use of the helicopter logging system than Alternative 4. It is estimated that Alternative 5 would require the use of 89 existing landings and 4 new ones (see Table 1, and Map 3 and Map 5 in the map packet).

A complete comparison of alternatives is contained in Table 1 (see also Appendix A for each action alternative’s unit-by-unit treatments proposed, and maps in map packet).

Connected Actions Associated With the Action Alternatives

Commercial Thinning

Commercial thinning proposed under all action alternatives would be the same, with the only difference being a slight variation in acres. The Douglas-fir vegetation series would be commercially thinned using a low thinning silvicultural prescription. Low thinning, or thinning from below, is the removal of trees primarily from the lower crown classes to favor those in the upper crown classes. Tree density varies within stands, but stands selected for thinning are typically well stocked or overstocked and have sufficient capacity to respond to thinning.

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 height and have the best opportunity to take advantage of onsite resources to maintain or increase growth. Treatments are designed to maintain the existing native species diversity, including hardwoods, in the units being treated. Generally, the following types of trees would be retained:

- All predominant conifers (larger, older trees left from previous stands that have large limbs, live-crown ratios generally greater than 50 percent, and diameters generally greater than 36 inches),

- Dominant conifers (trees from the current stand, live crown ratios generally greater than 40 percent and diameters generally 24 to 36 inches),
- Codominant and intermediate conifers with growing space in the canopy for crown development (trees from the current stand, live crown ratios generally greater 30 percent and diameters generally less than 24 inches),
- Healthy minor conifer species that could survive within the stand (i.e., sugar pine, ponderosa pine, and incense cedar), or
- Healthy dominant or codominant hardwood trees (particularly black oak and Pacific madrone), or pockets of smaller diameter hardwoods.

First priority for removal would be the smaller trees having the poorest crowns. These trees are normally below the average canopy and would eventually die as a result of competition for light, water, and nutrients. Some codominant trees would also be removed to increase growth of adjacent trees and to meet the desired residual stand density. Generally, the following types of trees would be removed from the stand:

- Suppressed conifers (live crown ratios generally less than 20 percent and diameters generally less than 12 inches),
- Intermediate conifers without growing space in the canopy for crown development (live crown ratios generally less than 20 percent and diameters generally less than 16 inches),
- Codominant conifers that do not have growing space in the canopy for further crown development (live crown ratios generally less than 30 percent and diameters generally less than 24 inches), or codominant trees needed to reduce stand density to desired levels, or
- Codominant, intermediate, and suppressed conifers adjacent to predominant conifers, dominant or codominant hardwoods, or pockets of smaller diameter hardwoods, to facilitate the survival of these trees.

Riparian Reserves

Within the project area, a total of 6,051 acres are within established riparian reserves whose widths correspond to a slope distance of 160 feet from the edge of the channel on perennial non-fish-bearing, intermittent, and ephemeral with scour streams, and a slope distance of 320 feet on fish-bearing streams. The inner one-half of the buffer width would be excluded from any treatment under all alternatives. No regeneration harvest would occur anywhere within riparian reserves for any alternative.

Silvicultural prescriptions would consist of low thinning as described above and would be the same for all action alternatives with the only difference being a slight variation in acres. Commercial thinning would occur on a small number of acres in plantations and in stands containing early through mid-mature seral stages within the outer half of the riparian reserve buffer. Silvicultural prescriptions are specifically designed to benefit stand conditions where the objectives are to increase the average diameter of the stand, and/or accelerate the development of

the shade tolerant understory. Accelerating the diameter growth of riparian stands would assist in creation of late-successional conditions and provide for a faster development of large woody material sources for instream and terrestrial habitat.

Logging Systems

Logging systems are similar for all action alternatives with a variation in the acres treated under each system. Three logging systems are proposed based on site conditions and existing road infrastructure. Ground or skyline-based systems would be used where units are accessible from either system or temporary roads. Ground-based yarding systems would be used to skid logs on slopes less than 35 percent using either tracked or rubber-tired skidders. Skyline yarding systems would be used on steeper ground (slopes greater than 35 percent). Helicopter yarding is proposed where the existing system and temporary road access is limited.

Transportation System Management

For all action alternatives, access to the project area would be via a series of county roads that exit to State Route 36 near the town of Mad River. These roads are all-weather, surfaced roads and are adequate for hauling timber. The bridge on County Road 504 that crosses Van Horn Creek has restricted load capacity and cannot be used by log trucks. Currently a low-water crossing east of the bridge accommodates these needs. The low-water crossing has no restrictions when the creek is dry; if there is water flowing, a designed crossing consisting of culvert(s) and clean rock or gravel would be required. Trinity County plans to install a temporary bridge at the low-water crossing until the County Road 504 bridge is replaced. If this occurs prior to implementation, a designed crossing would not be required.

The main system roads that serve the interior of the project area are NFS roads 2S05, 2S12, 2S13, 3S13, 3S31, 3S39, 27N16, and 27N34. All system roads needed for timber sale activities within the project area were developed under previous timber sales. No new system roads would be added to the National Forest transportation system. Existing system roads needed for the project would require light to heavy maintenance such as brushing, blading, spot rocking, slump repair, or culvert repair or replacement prior to operations. Dust abatement along roads during hauling operations would be accomplished by using water. All aggregate rock would come from existing rock sources within the project area and water source requirements for this project can be met from existing sources on NFS lands.

All or portions of NFS roads 2S12C (0.75 mi.), 3S05C (0.14 mi.), 3S51 (1.45 mi.), 3S51A (0.58 mi.), 3S51B (0.33 mi.), 3S51C (0.16 mi.), 3S53A (0.50 mi.), 3S53B (0.07 mi.), 3S55 (0.58 mi.), 3S39J (0.48 mi.), 3S39S (0.24 mi.), 27N02A (1.11 mi.), 27N18 (0.66 mi.), and 27N42 (0.35 mi.), and two unauthorized routes totaling 0.87 mile would be decommissioned upon project completion to reduce actual and potential sediment generated from these roads following use (Transportation Maps, Appendix C). Decommissioning would generally involve one or more of the following activities: 1) subsoiling or out-sloping the road surface; 2) removing drainage

structures, such as culverts; 3) installing water bars where needed; 4) mulching with native materials (logging slash) or certified weed free straw; and 5) placing earth or log mound barriers to prevent vehicle traffic.

Dead and dying trees that meet the established Six Rivers National Forest guidelines for hazard trees would be cut and removed along the entire length of NFS road haul routes. Logs resulting from hazard tree cutting that are located within riparian reserves and outside of road prisms would be left in place. It is difficult to predict how many trees would die, or would display signs of dying over the life of the project. The Forest Service timber sale administrator would identify specific hazard trees as the sale progresses.

Temporary Roads

The existing system road system, existing non-system roads plus new temporary roads (only in Alternatives 3 and 5) would be used to access ground-based and skyline treatment units. Treatment units not accessible by road would be helicopter logged.

New temporary roads would be located and constructed to minimize ground disturbance, protect resources, and provide safe transportation at the least possible cost. Existing temporary roads are generally old jeep roads or temporary roads constructed for past harvest activities. These roads require re-opening and would require a road grader to restore the surface prior to use.

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

Fuel Reduction Treatments

For all action alternatives, in addition to the treatment of fuels in the commercial harvest units, fuel reduction treatments would be prescribed in strategic areas identified by fuels specialists and along main access roads (see Map 4 in map packet). A variety of manual, mechanical, and jackpot burning methods would be employed as follows:

1. The burn prescription for jackpot burns calls for low to moderate-intensity burns with scattered small pockets of higher intensity burns due to heavier fuel concentrations. These burns would not fully consume the woody debris, needle/leaf litter or humus layer on the forest floor.
2. To protect sensitive features or vegetation from impacts during burning, remove surface fuels from any buffer area and cut a hand fireline to keep fire out of buffer.
3. Piling of slash material on extreme slopes (greater than 70 percent) generally would not occur. Consider biomass removal options.

4. Debris/slash piles should be built at least 5 feet away from areas to be protected and from trunks of leave trees, snags, down logs, and stumps to reduce scorching of remaining vegetation. Debris/slash piles would be covered to help keep the pile material dry prior to burning.
5. No piles would be placed in ditches, culverts, or on paved roads.
6. Where chipping is implemented along roadways, spread chipped material off roadway to a depth of less than 6 inches, avoiding ditches and culverts.

Treatment of Fuels Outside of Commercial Harvest Units

For all action alternatives, approximately 1,029 acres would be jackpot burned, either as a stand-alone treatment or following mechanical or hand treatments such as thinning of small-diameter trees or mastication. Actual acres burned are expected to be less based on site-specific fuels. Approximately 44 acres would receive a stand-alone treatment of mastication.

Thinning of trees may occur within burn units as necessary to modify fire behavior and assist with holding of firelines. Some fireline construction may be necessary around prescribed burn units. Treatments would include one or several of the following activities: cutting understory vegetation, lopping and scattering, hand or machine piling and burning, mastication, roadside chipping, jackpot burning, and fuelwood and biomass collection and removal. The treatment prescribed would be based on the vegetation type, hazardous fuel loading and distribution, and topography of the proposed treatment unit. These treatments are described as follows:

- **Cutting understory vegetation** - Cutting live and dead moderate to heavy brush, seedlings, saplings, and small diameter trees generally up to 12 inches diameter at breast height and limbing lower tree branches of overstory trees (generally up to 6 to 12 feet above the ground) to remove fuel “ladders” (continuous fuels from the ground up to the overstory canopy) that can accelerate fire spread and increase resistance to control. Work would be accomplished with chainsaws or low ground-pressure mechanical equipment.
- **Lopping and scattering** - Existing ground fuels, thinning and pruning residue, and cut brush would be cut into smaller pieces and scattered to a maximum depth of 18 inches.
- **Hand/machine pile and burn** - Existing ground fuels, thinning and pruning residue, and cut brush would be piled and burned.
- **Roadside 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** - Low ground-pressure mechanical equipment (similar to a mowing machine) would be used to cut live vegetation. Material would be masticated up to approximately 4 to 6 inches above the ground surface.
- **Jackpot burning** – Slash left from treatments would not result in uniform amounts of fuels across the forest floor. Therefore, it would only be necessary to ignite scattered areas that have excessive fuels. Jackpot burning involves igniting only concentrations of

fuels created during treatment and then allowing fire to move between concentrations at a very low intensity if possible. In many cases, the interspaces will not burn because of a lack of fuels. Cutting of brush and small trees along control lines and within units could be done to modify fire behavior. Hand or machine constructed control lines would be used to limit the spread of fire.

- **Biomass utilization -** Opportunities would be provided in accessible areas to collect cut vegetation for fuelwood or biomass utilization.

Treatment of Fuels inside Commercial Harvest Units

Treatments of activity fuels would vary by logging system and proximity to private land. One or several of the following methods would be used to treat harvest-generated fuel:

- lopping and scattering slash to a maximum depth of 18 inches,
- hand or machine piling and burning piles within ground-based units and portions of helicopter units adjacent to private land,
- yarding tops out of units and piling on landings for future disposal on all ground-based and skyline units, and some helicopter units adjacent to private land,
- felling of unutilized material less than 8 inches in diameter where it would constitute a safety hazard, or
- jackpot burning on all ground-based and skyline units, and some helicopter units with adjacent roads.

Treatment of fuels created during timber harvest activity would be accomplished primarily through yarding of tops to landings for disposal by burning or chipping. However, it is also anticipated that an additional 25 percent of these acres would need follow-up treatments to deal with fuel loading from stem breakage and removal of limbs during tree falling and bucking, as well as natural fuel concentrations. Yarding of tops would be a requirement of the timber purchaser, while follow up treatment costs would be split between the purchaser and Forest Service funding for hazardous fuel reduction. Yarding tops would be required on all ground-based and skyline units, and some helicopter units along private land or where there is a concern for fire-suppression access or potential for extreme fire behavior.

Lopping and scattering by itself may be appropriate in some situations such as in remote units away from the road where the risk of ignition is lower, or for erosion control on specific skid roads. Lopping and scattering and/or jackpot burning would be emphasized in harvest areas with moderate to high pre-harvest fuel levels. Treetops and unmerchantable material yarded out of harvest units would be decked on landings associated with each unit. If these areas are not large enough to accommodate the volume of material, existing landings along haul routes that are not associated with proposed harvest units could serve as alternate sites for the excess material. This material would be made available for firewood and biomass utilization for at least two seasons. After that time, any remaining material may be burned. Some existing fuel would be reduced coincidental to treating harvest-generated fuel.

Lop and scatter with machine grapple piling would be used as a follow-up treatment as needed on ground-based units in areas of heavy stem breakage and/or natural fuels concentrations. Lop and scatter with jackpot burning would be the follow up method on skyline units, while on helicopter units, different combinations of lop and scatter, hand piling, and jackpot burning would be used. Biomass utilization would be implemented wherever feasible.

Fuel-treatment Corridors

Strategically located fuel-treatment corridors (1,191 acres) would be constructed as part of all action alternatives along the following high-use roads: County Road 504 and NFS roads 27N34, 27N34D, 27N16, 3S13, 3S05, 3S39, 3S39R, and 2S12 (see maps and tables in Appendices A and B). Approximately 300 acres within fuel treatment corridors would be jackpot burned following mechanical or hand treatments such as thinning or pruning of small-diameter trees or mastication. Approximately 300 acres within fuel treatment corridors would receive mechanical or hand treatments such as thinning or pruning of small-diameter trees or mastication followed by hand piling, then hand pile burned.

These fuel-treatment corridors would reduce fuel loading to create safe access for fire suppression resources, decrease the potential for detrimental wildfire effects to the overall project area and communities in the vicinity of Ruth. Fuel-treatment corridors would generally be 300 feet in width on each side of the road. Actual widths may vary based on environmental features such as topography, vegetation distribution, and recent fire history. Treatments would involve the thinning of trees generally 12 inches and smaller, cutting of understory vegetation, tree pruning, mastication of brush, lopping/scattering of fuel, and jackpot burning, hand or machine piling of fuel and burning of piles. Biomass removal would be utilized wherever possible. In many areas, these corridors overlap with commercial thinning units.

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. Moreover, these features are intended to assure project compliance with the resource protection standards and guidelines of the Six Rivers National Forest LRMP, as well as compliance with other Federal and California State laws, regulations, and policy.

Soil, Water, Fish

1. For each unit, soil porosity would be maintained to at least 90% of its natural condition over at least 85 percent of the unit area (LRMP S&G 1-2, p. IV-71).
2. Ground-based equipment would be limited to slopes of 35 percent or less in order to minimize soil disturbance and subsequent erosion (LRMP S&G 1-8, p. IV-71).
3. Skid roads and trails would be limited to no more than 15 percent of the harvest area (LRMP S&G 1-4, p. IV-71).

4. At the end of project activities, a layer of litter and duff would occur over at least 50 percent of the activity area (LRMP, Appendix L-1).
5. In all treatment units, retain (at least five logs per acre) existing coarse woody debris (at least 20 inches in diameter and 10 feet long) on the ground and protect from disturbance.
6. All temporary road construction or reconstruction would occur during the dry season or when conditions allow.
7. In the event any temporary road construction produces unforeseen seeps (wet areas), that segment of the road would be rocked.
8. New or reconstructed landings would be shaped to disperse drainage. Erosion prevention measures such as cross ditches, rock armoring, straw bales, or slash would be used as necessary to direct water to areas of suitable drainage and capture sediment. New landing fill slopes and road fill slopes (greater than 100 sq. ft) would be mulched.
9. Logging and haul operations normally occur from May 15 to October 15 or when conditions allow. During wet weather conditions, the Six Rivers National Forest Weather Operating Standards would be followed.
10. Skid roads and trails would be located on ridge tops, flat benches, or on existing skid trails (to the extent possible) in order to minimize soil disturbance.
11. Skid roads would be water-barred upon completion of use.
12. To reduce the potential for soil erosion and compaction in units 3, 39, 42, and 85, tractor skidding would be allowed only when the top 10 inches of soil is dry.
13. Logging and hauling operations along temporary road 59-1 would be allowed only during the normal operating season under dry conditions.
14. Steep draws and channels that do not exhibit annual scour would be protected as needed through measures such as equipment exclusion and designated stream crossings.
15. Sub-soiling would occur on ground-based units with existing soil compaction levels over or near the 15 percent standard (units 3, 39, 42, and 85). Sub-soiling would be to a depth of approximately 18 inches on temporary roads, landings, and within the first 100 feet of arterial skid roads that connect to a landing. Sub-soiling in unit 39 may not be necessary if directional falling and endlining of logs to NFS roads eliminates the need for ground-based equipment within the unit.
16. During water drafting operations, the intake end of the hose would be screened to avoid direct injury to aquatic species.
17. Fuel and other petroleum products must be stored, and refueling must occur, at least 100 feet from any stream or other sensitive waterbodies.

Riparian Reserves

1. Riparian reserves widths correspond to a slope distance of 160 feet from the edge of the channel on perennial non-fish bearing, intermittent, and ephemeral with scour streams, and a slope distance of 320 feet on fish-bearing streams.
2. Temporary road crossings within riparian reserves would be recontoured and left in a hydrologically stable condition at the end of project activities. Landings should be located outside of riparian reserves except for unit 59, where an existing landing is located within a riparian reserve.
3. Thinning or fuel reduction treatments could occur within the outer width of riparian reserves; generally 80 to 160 feet from the channel or break in slope, whichever is greater on non-fish-bearing perennial, intermittent, and ephemeral streams, and 160 to 320 feet or break in slope on fish-bearing streams and rivers. An average canopy closure of 60 percent or greater would be maintained within the treated portions of the reserves.
4. No hand piles would be constructed within the inner portion of a riparian reserve. Fuel may be hand-piled in the remainder of the riparian reserve. Maximum size of hand piles would be 6 feet wide by 6 feet high. Hand piles would be placed in a checkerboard pattern whenever possible (not one pile directly above another)
5. No firelines would be constructed in riparian reserves.
6. Fuel reduction treatments that include the cutting and/or removal of live and dead vegetation 8 inches or less in diameter could be implemented within the inner portions of riparian reserves (0 to 80 feet or break in slope on perennial non-fishing-bearing, intermittent, and ephemeral with scour stream channels, or 0 to 160 feet or break in slope on fish-bearing channels).
7. Skyline yarding corridors that cross a riparian reserve would not exceed 15 feet in width and full log suspension would be required within 50 feet on either side of the stream channel. Within the rest of the riparian reserve, at least one end log suspension would be required.
8. Trees cut down to create skyline suspension corridors within the untreated portions of a riparian reserve would remain on site.
9. Logs resulting from hazard tree felling that are located within the inner portion of riparian reserves and outside of road prisms would be left in place. Only the limbs from these logs would be lopped and removed from to reduce fuel loading.

Wildlife

Northern Spotted Owl

In suitable northern spotted owl nesting and roosting habitat:

1. Protocol surveys for northern spotted owls would be conducted in 2009 to determine occupancy and nesting status in 2008 and 2009:
    a. If northern spotted owls are found to be nesting, prohibit operations from February 1 through September 15 within a 70-acre nest core area.

b. From February 1 through July 9, prohibit all timber harvest, heavy equipment use, chainsaw use, helicopter yarding, temporary road construction, and smoke-producing activities within 0.25 mile of any known northern spotted owl activity center or known nest.

2. Post-project canopy closure in treated stands would be 60 percent or greater ensuring that suitable nesting/roosting habitat remains suitable post-project.
3. Jackpot or pile burning may occur during the northern spotted owl breeding season if surveys indicate no activity centers are within 0.25 mile of burning activities. Within 0.25 mile of an activity center, the wildlife biologist would make a field assessment of an activity center's location relative to topographic features that would minimize risk to activity centers from jackpot or pile burning from February 1 through September 15, and other smoke-generating activities from February 1 through July 9.
4. Helicopter flight paths would avoid known nest sites during the breeding season (February 1 to August 31). Helicopters should fly at least 500 feet above the canopy until it reaches the project site. Flight paths should be located at least 0.25 miles and landing sites should be located 0.5 miles from known nest sites.

Northern Goshawk

In established northern goshawk primary nest zones and foraging habitat zones:

1. Restrict habitat-modifying activities between March 1 and August 31 within the primary nest zone (0.5-mile radius). Restrict activities producing loud and/or continuous noise within 0.25 mile of active nest sites;
2. Landing sites should be located 0.5 mile from known northern goshawk nest sites; and
3. Helicopter flight paths should be located at least 0.25 mile from known northern goshawk nest sites.

Snag and Log Retention Guidelines

1. All existing large snags (20 inches in diameter or greater) within treatment units would be retained unless they pose a safety hazard during operations or to the public.
2. Cull logs (those not meeting minimum merchantable sawlog standards) would be left in units where the average number of existing large down logs per acre (20 inches in diameter or greater and 10 feet or greater in length) is less than the average density by series and seral stage as listed in Table IV-8 of the Six Rivers LRMP (p. IV-79).
3. Slash piles should be at least 5 feet from leave trees, snags, and down logs to minimize the risk of burning these habitat components.

Botany (Forest Service Sensitive and Survey-and-Manage Botanical Species)

1. Mountain lady's slipper (*Cypripedium montanum*) is categorized as both a Forest Service sensitive and survey-and-manage species. The design features identified for this species meets both the intent of managing the population as a sensitive species and managing

known sites for species' persistence as defined in the 2001 Record of Decision pertaining to survey-and-manage species.

a. No treatments would occur within no-disturbance buffers established around mountain lady's slipper detections in units 75d, 93a and in the Forest Service road 3S05 fuel corridor. Buffers range in size from 1.3 to 2 acres to account for indirect effects. All other mountain lady's slipper populations were likewise delineated in the field and in addition unit boundaries were changed to exclude the population. Population delineations ranged in size from 0.8 to 6.5 acres. .
b. Under Alternative 3 only, the no-disturbance buffer established around the mountain lady's slipper population in Unit 75d would be expanded from 2 to 3 acres to account for the regeneration silviculture prescription proposed for that unit.
c. Buffers around populations would be delineated by equipment exclusion signs.

2. Tracy's sanicle (*Sanicula tracyi*) is categorized as a Forest Service sensitive species. Populations are associated with proposed fuels unit 151 and a fuel treatment corridor along Forest Service route 27N34. All populations are managed under a conservation strategy for the species (Hoover 1999, 2008) which can include vegetation manipulations identified to benefit Tracy's sanicle or the integrity of its habitat.
   a. Unit 151:
      i. No ground-based disturbance would be allowed within the no-disturbance buffer in unit 151. The site would be delineated by equipment exclusion signs;
      ii. Manual removal of conifers smaller than 15 inches DBH (diameter at breast height) is permissible within the buffer, as coordinated by the botanist;
      iii. No piling and burning is permissible within the no-disturbance buffer; and
      iv. Marking conifers for cutting and removal would be coordinated with the botanist.
   b. Fuel treatment corridor along 27N34:
      i. No activities would occur within the no-disturbance buffer in the fuels treatment corridor; and
      ii. The site would be delineated by equipment exclusion signs.
3. *Dendriscocaulon intricatulum* is designated as a survey-and-manage lichen species. The design features identified for this species meets the intent of managing known sites for species' persistence as defined in the 2001 Record of Decision. *Dendriscocaulon intricatulum* is located in commercial units 76a and the portion of unit 32 along side Forest Service road 2S05, and in the fuel treatment corridors east of unit 32 (on Forest Service road 3S39) and north of unit 102 (on Forest Service road 27N34). All sites are protected by a 50-foot radius buffer. In addition, silvicultural objectives to retain the

hardwood component in the commercial units will provide suitable substrate for recruitment. The following design features would apply in these locations:

a. Retain all flagged trees;
b. No piling within 50 feet of an occupied tree;
c. No burning within the 50-foot buffer;
d. Retain small diameter oaks smaller than 12 inches DBH; and
e. Temporary roads would be located at least 25 feet away from occupied trees.

Noxious Weeds

Treatment site specifications are identified in the Noxious Weed Risk Assessment for this project (Schreiber 2009).

1. Equipment would be cleaned prior to entry into the project area to prevent the incidental introduction of noxious weeds.
2. Progression of work would be scheduled from north to south to reduce the potential of moving weed seed from moderate to heavily infested areas (i.e., south of Forest Service route 3S13) to relatively weed-free areas within the sale area.
3. To reduce the risk of spreading yellow starthistle from heavily infested areas to uninfested areas, operations occurring off infested road segments identified in the Noxious Weed Risk Assessment would be completed and equipment cleaned at least once before moving elsewhere. Equipment cleaning sites would be designated at select locations south of Forest Service route 3S13.
4. Yellow starthistle sites along infested roadbeds and in landings would be treated (i.e., manually, mechanically, or using organic-based herbicides) prior to operations to reduce or remove maturation of seed head development when equipment is operating in the area until operations are completed, thereby reducing the incidence of exporting weed seed. After initial treatment, subsequent treatments would occur after follow-up inspections and be retreated at intervals throughout the operating period as applicable (i.e., in order to keep seed heads down and to prevent bolting. For example, after initial treatment, recheck and monitor site after two weeks and retreat yellow starthistle if plants have bolted.)
5. At specific landings where containment of an isolated occurrence and possibly eradication is an option, landings will be site prepped and revegetated consistent with Six Rivers National Forest revegetation guidelines or covered to a depth of 4 inches with native mulch material (e.g., finely masticated material) or weed-free mulch upon completion of landing-related activities.
6. To reduce the incidence of spreading yellow starthistle, mastication machines would not operate in areas of heavy yellow starthistle infestations.
7. Imported soil, rock, mulch or other foreign material used in any part of this project shall originate from a weed-free source.

Cultural Resources

1. Any known eligible cultural sites would be protected through avoidance.
2. If new cultural resources are discovered during project implementation, all work would cease in that area until assessed by an archeologist.
3. Monitoring for archeological sites would occur throughout project implementation activities with priority being given to road and landing construction and reconstruction, harvesting, and burning activities.
4. In some treatment units, post-clearing surveys would be completed in areas too dense to survey before treatment, per Programmatic Agreement with the State Historic Preservation Office and the Federal Advisory Council on Historic Preservation, “Interim Protocol for Non-Intensive Fuels and Vegetation Reduction Projects.”

Air Quality

1. Dust abatement would be required along NFS roads used for timber hauling as specified under timber sale contract provisions.
2. Jackpot and pile burning would be accomplished under Federal, State, and local guidelines as administered by the North Coast Unified Air Quality Management District.

Recreation and Scenery

The following design features apply to the immediate foreground (1 to 300 feet on either side or circumference of the resource) that can be viewed by the casual forest visitor traveling along County Road 504 and/or the Discovery Trail.

1. Timber designated for removal would be cut-tree marked.
2. Stumps would be cut flush to the ground or within 6 inches of the uphill side of the stump, whichever allows the stump to be shorter.
3. Where lop and scatter is the prescribed fuel treatment, slash would be lopped and scattered to a depth of 12 inches or less.
4. Tree prune heights would not exceed 10 feet or 1/3 the tree height, whichever is less.
5. Shrub islands of various shapes and sizes would be left in a random distribution in fuel treatment corridor to provide a natural appearance.
6. Placement of skid trails should be avoided within 100 feet of County Road 504 and Discovery Trail where practical.
7. Cable corridors would be kept to a minimum width.
8. Dispersed recreation sites used for harvest operations would be restored or rehabilitated.
9. Any trail corridor would be protected or rehabilitated after completion of activities.

Public Safety

1. Traffic controls and cautionary signing would be implemented during operations and log haul as specified under contract provisions.

Comparison of Alternatives

Table 1 provides a summary of the effects of implementing each alternative. Information presented is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 1. Comparison of alternatives

Project Features	Alternative 1 (no action)	Alternative 3 (includes regeneration harvest)	Alternative 4 (no temporary roads)	Alternative 5 (modified proposed action)
Logging systems (acres)				
Ground-based	0	607	593	619
Helicopter	0	362	801	394
Skyline	0	1,413	1,076	1,458
Totals	0	2,382	2,471	2,471
Riparian reserve treatments (acres)				
Acres treated	0	529	618	618
Fuel treatments within commercial thinning units [1] (acres)				
Lop and scatter	0	635	645	650
Hand pile and hand pile burning	0	127	133	127
Machine pile and machine pile burning	0	152	155	155
Jackpot burning	0	508	510	522
Fuel treatments outside of commercial thinning units [1] (acres)				
Jack-pot burning in grey pine/oak and Douglas-fir stands	0	680	680	680
Mechanical mastication of brush (some with burning)	0	89	89	89
Fuel treatment corridors		1,191	1,191	1,191
SIGNIFICANT ISSUES				
Provide sustainable timber supply (acres)				
Acres of thinning	0	2,177	2,471	2,471
Acres of regeneration	0	205	0	0
Harvest volume [2]	0	28.1 MMBF	24.0 MMBF	24.0 MMBF
Impact of roads on the health of the watershed (miles)				
System roads maintained or improved	0	63.3	63.3	63.3
Existing temporary roads decommissioned	0	2.9	1.7	2.9
Temporary road construction and decommissioned	0	5.3	0	5.3
System roads decommissioned	0	7.4	7.4	7.4
Unauthorized routes decommissioned	0	0.87	0.87	0.87

1 - Not all acres within a treatment unit or corridor would be treated. The type and extent of treatments would be determined on a site-specific basis. Acre figures are an estimate based on best professional judgment.

2 – MMBF = million board feet

Chapter 3. Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

Biological Environment

Vegetation

Affected Environment

Vegetation composition is largely determined by climate, along with local aspect, elevation, and precipitation patterns. The project area runs approximately 10 miles from the southeast to northwest direction along the Mad River extending 2 to 3 miles southwest up to Mad River Ridge. Elevations vary from approximately 2,800 feet along Mad River to 4,300 feet on Mad River Ridge. Major drainages tend to flow northeast creating large variations in slope orientation, which is a major influence on vegetation types found in this area. Annual precipitation at Ruth Lake is approximately 40 inches, and average precipitation for the Upper Mad River Watershed is 60 inches.

Douglas-fir is the dominant plant series covering approximately 80 percent of the project area (Table 2). The Douglas-fir series is found at mid-elevations on warm, moist inland sites of moderate productivity where frequent fire played a large role in the past (Jimerson et al. 1996). The Douglas-fir/black oak subseries is predominant here. California black oak and Pacific madrone are the primary hardwood species, with occasional bigleaf maple. Typical understory vegetation consists of hazel, poison oak, scrub oak, madrone, hawkweed, pathfinder, rose, snowberry, bunchberry, and fescue. Hazel, scrub oak, and bunchberry typically indicate moister conditions, while snowberry, poison oak, madrone, hawkweed, and rose indicate drier sites.

Fire has been an important disturbance factor in the planning area. Evidence of past fire is common on pre-dominant trees having fire scars from old surface fires. Much can also be inferred from the dominance of early- and mid-mature seral stages found here. The fire regime within the planning area would generally be considered a moderate (mixed) severity regime with periods of stand-replacing fire (Jimerson et al. 1996). Tree ring and fire scar studies in the Douglas-fir series on the Six Rivers NF found that the mean fire return intervals varied from 13 years in the south to 21 years in the north (Adams and Sawyer 1980 In: Jimerson et al. 1996). Taylor and Skinner (2003) reported median fire return intervals of 11 to 16 years for Douglas-fir/tanoak sites near Hayfork, CA to the north of the planning area. Stand-replacing fire events historically created large areas of young forest, during drought periods from 1860 to 1890 and 1915 to 1935. These

events likely resulted in the current dominance of early (70- to 110-year-old)- and mid-mature (110- to 150- year-old) stands (UMRWA 1998).

The fire regime condition class is considered to be generally outside the natural/historic range of variation for the Douglas-fir series and white oak-conifer types. At these elevations and latitude there is likely departure from historic conditions, since lower precipitation and the hotter and drier summertime conditions would have lead to more ignitions from lightning and human sources than more mesic sites at higher elevations. These more frequent fires would indicate a mixed-severity regime with underburning and creation of small patches of regenerating forest.

Timber stands are mainly dominated by relatively even-aged 80- to 120-year-old Douglas-fir trees with varying amounts of pre-dominant Douglas-fir, ponderosa pine, and sugar pine. Many stands appear to have a mosaic of several age classes in them indicating regeneration over several decades with fire possibly contributing to this “patchiness”. These stands are thought to be the result of large stand-replacing fires during the late 1800s.

The amount of black oak in stands varies greatly with most stands having black oak relegated to a subordinate position in the canopy. This is likely due to the reduction in fire and competition from Douglas-fir. Madrone is the most aggressive hardwood species after disturbance. Tanoak distribution is very limited here.

Table 2. Acres of vegetation series in the Beaverslide project area*

Series	Acres	Percent
Annual grassland	158	1.3
Canyon live oak	286	2.4
Douglas-fir	9,357	79.4
Grey pine	222	1.9
Non-vegetated	73	0.6
Oregon white oak	1,098	9.3
Ponderosa pine	519	4.4
Shrublands	5	0.0
Tanoak	45	0.4
White fir	6	0.0
Willow	10	0.1
No data	10	0.1
Totals	**11,790**	**100.0**

* National Forest System lands only

Stand Structure

The current stand structure (tree sizes/ages, species composition, and spatial distribution) is the result of growth over time and past disturbances. 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

inches diameter at breast height (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 inches 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 inches DBH (size class 3). Early mature stands are further characterized by the presence of large scattered predominant conifers generally greater than 36-inches 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 inches DBH (size classes 3 and 4; 11- to 21-inches and 21- to 36-inches 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 trees within the top layer of conifers that are 30 inches DBH or larger (size classes 4 and 5; 21 to 36 inches and 36 inches DBH and larger). 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 inches DBH (size classes 4 and 5). Old growth with evidence of past harvest is classified as old growth harvest (OH).

Under the 1995 LRMP, the distribution of seral stages by vegetative series is evaluated relative to recommended management ranges (RMRs) at a landscape scale. For this project, the scale of the landscape is the south zone of the Forest, which consists of the Mad River Ranger District. The distribution of seral stages across the south zone is quite variable. This is due, in part, to the mixture of vegetative series across the landscape. While conifer forests account for approximately 73 percent of the vegetation across the zone, they are interspersed with 17 percent oak woodlands, two percent hardwood forests, and five percent shrub-grasslands. These types generally occur in the younger seral stages (shrub/forb, pole, and early mature). This combination of vegetation types contributes to a mosaic of seral stages across the landscape.

Natural and human-caused disturbance also influence seral stage progression. Developing stands can be set back to the shrub/forb stage at any time by stand-replacing disturbances such as fire, wind, floods, or regeneration harvest. In some areas, high-intensity fire or regeneration

timber harvest may replace a mature forested area with an early shrub/forb-dominated seral stage. In other areas, low- to moderate-intensity fire or intermediate type timber harvests (i.e., thinning, individual tree selection) may result in minor changes that are insufficient to change the seral stage based on the remaining stand structure.

Seral stages for the Douglas-fir vegetative series for the south zone, Upper Mad River Watershed and the Beaverslide project area are compared to the recommended management ranges in Table 3. The existing seral stage distribution for the Douglas-fir series in the south zone is within the desired ranges with the exception of the old-growth stage. Early-mature and late-mature values are at the upper end of the recommended management range value. Values for the watershed and project area are similar, except that the project area contains more mid-mature and less old growth in general than the other areas.

In order to better describe the Douglas-fir series stands in the planning area, they were stratified by seral stage and stand-type. This resulted in six strata, which are presented in Table 4. These strata include stands that have had previous selection or thinning harvest.

Table 3. Percent of area by seral stage for Douglas-fir series and recommended management ranges (RMRs)

Seral stage	South zone (%)	Upper Mad Watershed (%)	Beaverslide Project Area (%)	RMRs (south zone) (%)
Shrub/Forb	4.5	6.4	5.1	N/A
Pole	9.2	11.4	10.6	N/A
Early-mature (EM)	33.5	37.7	35.4	16 to 35
Mid-mature (MM)	29.8	25.4	31.1	25 to 35
Late-mature (LM)	14.2	14.1	14.4	9 to 14
Old growth (OG)	8.7	5.0	3.6	11 to 20

Table 4. Stratification of Beaverslide project area by seral stage

Stratum	Seral stage	Age (years)	Dominant species
1	EM	70-100	Douglas fir (DF)/CA black oak (BO)
2	EM/EA	70-100	DF
3	MM	80-125	DF
4	MA	80-125	DF
5	PH	15-50	DF/ponderosa pine (PP)
6	LM	150+	DF

EM - Early mature, EA - Early with predominates, MM - Mid-mature, PH - Pole past harvest, LM - Late mature

Stand Densities

Even though the existing condition for all seral stages except old growth are within the recommended management ranges, existing tree densities within early- and mid-mature even-aged stands are denser that what is desired (Table 5). Trees in these sites have occupied all growing space and new trees are now excluded from becoming established. Variations in height growth have occurred to various degrees, with some trees expressing “dominance” over other trees to the point that many are overtopped, receiving no direct sunlight.

Stand density in all strata is currently at the point where inter-tree competition can be expected to lead to mortality, which has been noted in several stands. Relative density (RD) measures are above recommended stocking levels of 30 to 50 (Curtis 1982) for optimizing individual tree and stand growth. The existing high stand densities for early to mid-mature stands found in the Beaverslide project area (Table 5) indicate that stand vigor and growth is declining for all strata.

Table 5. Stratum averages of stand parameters from stand exams (all values are for trees 5 in. DBH and larger)

Stratum	Average DBH	Average relative density (RD)	Recommended RD range
1- EM	16.4	68	30 to 50
2- EM/EA	17.0	75	30 to 50
3- MM	17.5	80	30 to 50
4- MA	20.6	67	30 to 50
5- PH	12.5	65	30 to 50
6- LM	23.1	48	30 to 50

DBH – diameter at breast height, EM - early mature, EA - early with predominates, MM - mid-mature, PH - pole past harvest, LM - late mature, MA - mid mature with predominates

Late-successional Forests

An important element of the Northwest Forest Plan and the LRMP is the retention of late-successional forests. Landscape areas where little late-successional forest persists should be managed to retain late-successional patches. This standard and guideline is applicable to 5th-field watersheds (20 to 200 square miles) in which Federal forest lands are currently comprised of 15 percent or less late-successional forest. The watershed is approximately 79,600 acres, of which 68,652 acres are administered by the Six Rivers National Forest, with the remainder in private ownership.

An assessment of late-successional forest on National Forest System lands within the watershed utilized the definitions and criteria for late-successional stands contained within the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl (NFP FSEIS). Late-successional stands are defined as “forest seral stages, which include both mature and old-growth age classes” (NFP FSEIS, Glossary p.9). The definition for a mature stand is “A mappable stand of trees for which the annual net rate of growth has peaked. Stands are generally greater than 80 - 100 years old…” (NFP FSEIS, Appendix A, and FEMAT Report, p. IX-20). The assessment further defines which mature structural classes are considered late-successional forest (NFP FSEIS p.3&4-26). Table 6 provides a comparison of the NFP FSEIS structural classes and the corresponding seral stages in the Forest LRMP.

Table 6. Comparison of NFP FSEIS late-successional structural classes and Six Rivers LRMP seral stages

NFP FSEIS structural class	NFP FSEIS definition	Six Rivers LRMP seral stages
Small Conifer	Youngest seral category includes stands of trees generally 9 to 21 inches DBH. A minority of the stands in this category have scattered large overstory trees that provide late-successional forest characteristics.	Early and mid mature stands, size class 3 (11 to 21 inches DBH), with scattered predominant trees ≥ 36 inches DBH (size class 5). Seral stages EA, EB
Medium/Large Single-storied Conifer	Stands dominated by conifer trees that are 21 to 32 inches DBH, characterized by only a single canopy layer. These stands qualify as late-successional forest.	Mid mature stands, size class 4 (21 to 36 inches DBH). Seral stages MM, MA, MH, and MB.
Medium/Large Multi-storied Conifer	Stands dominated by conifer trees that are greater than 32 inches DBH, and are characterized by two or more canopy layers. These stands generally best fit the definition of old growth forest.	Late mature and old growth stands, size classes 4 and 5 (21 to 36 inches DBH and ≥ 36 inches DBH). Seral stages LM, LH, OG, and OH.

Data for the Upper Mad River watershed was extracted from the updated 2008 vegetation layer for the Mad River Ranger District (south zone) and used to determine the amount of late-successional forest present in the watershed. It was assumed that in addition to meeting the criteria for size and seral stage as described in Table 6, the stands must also have a minimum of 60 percent total canopy cover and a minimum of 40 percent canopy cover in conifers. Table 7 presents the results of the query for late-successional forest.

There are 28,818 acres of late-successional forest on NFS lands within the watershed, representing approximately 42 percent of the watershed. This figure is well above the 15 percent threshold (Table 7). Of the 2,471 acres proposed for harvest in this project, approximately 1,300 acres or 53 percent are classified as small conifer or medium/large single-storied conifer late-successional forest. No late-mature or old-growth forest is proposed for harvest.

Table 7. Acres of late-successional forest on National Forest System lands, Upper Mad River Watershed

NFP structural class	LRMP seral stages [1]	Size class	Douglas-fir series	Ponderosa pine series	Tanoak series	White fir series	Totals
Small conifer	EA,EB	11-21 in.	5,020	293	15	1,032	6,360
Med/large single storied conifer	MM,MA, MH,MB	21-36 in.	10,131	349	0	1,800	12,280
Med/large multi-storied conifer	LM,LH, OG,OH	21 in. plus	8,354	82	30	1,711	10,177
Totals			23,505	724	45	4,544	28,818

1 EA – early mature natural with predominant trees, EB – early mature harvest with predominant trees, MM – mid mature natural (no harvest), MA – mid mature natural with predominant trees, MH – mid mature harvest (displaying some tree harvest), MB – mid mature harvest with predominant trees, LM – late mature natural (no harvest), LH – late mature harvest (displaying some tree harvest), OG – old growth natural (no harvest), OH – old growth harvest (displaying some tree harvest).

Changes from Historic Conditions

Late-Mature/Old-Growth Stands

Based on current vegetation mapping, the old-growth seral stage for Douglas-fir is below recommended management ranges from the LRMP. The recommended management range is considered a subset of the historic range of variability that is chosen to reflect current management objectives and allow for risk of large disturbances. The main reasons for this departure are the large stand-replacing fires that occurred during the late 1800s and early 1900s, regeneration timber harvest, and the suppression of mixed-severity fire events over the last several decades that would have served to naturally thin stands and accelerate the development of more structurally complex stands. Since the late-mature stage is at the high bound of recommended management range, and the mid-mature stage is at the mid-point, the Forest should be able to achieve the recommended management range for old growth over the long term.

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 the Douglas-fir stands, as well as contributing to the continued loss of black oak through competition from Douglas-fir. Because of fire suppression since the early 1900s, 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).

Permanent forest inventory plots have revealed a continuing increase in stand densities over the previous 30 years, with a concurrent decrease in black oak representation (USDA Forest Service 1998). This finding is consistent with stand data from the project area, where Douglas-fir stocking is above desired levels (see Table 5). It has also been noted within the project area that white oak savannahs are being replaced with conifers as noted in the Upper Mad River Watershed Analysis.

Stand structure and fuel arrangement is now such that stand-replacing, high-severity 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 dead and dying trees 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 dense pole plantations created after regeneration harvest are very susceptible to damage from both surface and crown fire.

Prescribed Fire: Due to existing dense stand conditions, the use of prescribed fire in Douglas-fir stands without reductions in stand density and fuels by mechanical means would be

difficult, costly, and pose risks to firefighters and local communities. Many areas of white oak glades, especially along potential control lines are also in need of mechanical treatment prior to use of prescribed 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. Tree mortality from competition and physical damage is variable, and current snag densities are variable. Down wood conditions are similar to snag conditions in that they are composed of small logs from competition-related mortality and large logs in advanced states of decay.

Environmental Consequences (Vegetation)

Alternative 1 – No Action

Direct Effects

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

Indirect Effects

Under this alternative, 2,382 to 2,471 acres would not be treated by commercial harvest, 1,118 acres would not be treated by fuel treatments, and 1,191 acres would not be treated to create fuel treatment corridors. By taking no action, the purpose and need to provide timber commodities that contribute towards the Forest's goal to provide a sustainable, predictable, long-term timber supply for the local economy would not be met. There would not be the opportunity to harvest approximately 24.0 to 28.1 million board feet of timber. Tree mortality from inter-tree competition would continue and increase within overstocked stands and this mortality would not be captured as part of the harvest and would not be made available to the local economy.

The average relative density (RD) for early-mature and mid-mature seral stages were 68 to 80 which is significantly above the desired levels of 30 to 50 (see Table 5). Commercial harvest and fuel treatments were designed to improve forest conditions by thinning overstocked stands, which would lead to improved forest conditions. Without these treatments, young stands would continue to grow at their current high densities. Measures of stand density indicate that competition-related mortality is expected to increase as resources on the site become limiting. The current density also has lead to susceptibility to physical damage from winter storms, and this effect has been noted in some stands. Lack of treatments now would limit future management options with overstocked stands being less resilient to weather disturbances. 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 lack of late successional forests with the loss of up to 100 years of growth in these stands.

Alternatives 3, 4 and 5

Alternative 3 commercially thins 2,177 and Alternatives 4 and 5 thin 2,471 acres (see Table 1, Chapter 2 and Proposed Commercial Harvest Area Maps, Appendix C). Alternative 3 replaces

205 acres of thinning with regeneration treatments and commercially thins 89 fewer aces within the riparian reserve. The effects from commercial thinning on vegetation would essentially be the same for all action alternatives. The location of acres thinned and the thinning prescription is the same for all alternatives. The primary difference between these alternatives is the logging systems used, which would result in fewer roads being needed for Alternative 4. The environmental effects caused by a change in logging systems will be discussed in detail in the, soil, and watershed discussions and the economic effects will be discussed in the economic section

Silvicultural Treatments

By project design, high-quality northern spotted owl nesting/roosting habitat was avoided. This includes late-mature and old-growth stands, and some mid-mature stands with higher numbers of predominant trees. Out of 3,276 acres of northern spotted owl nesting-roosting habitat, only 492 acres of the lower-quality habitat are proposed for treatment.

All action alternatives would employ thinning from below (Tappeiner et al. 2007) in the early-mature and mid-mature Douglas-fir stands ranging in age from 70 to 125 years. No late-mature or old growth stands would be treated. Units proposed for thinning are in the Douglas-fir vegetation series, with Douglas-fir/black oak being the predominant vegetative subseries.

Direct and Indirect Effects

Forest Health and Resiliency to Disturbance - The proposed action differs from most past actions in that previous timber harvest consisted of clearcut logging, broadcast burning, and planting with Douglas-fir and ponderosa pine seedlings. The silvicultural prescriptions proposed in Alternatives 4 and 5 are intermediate treatments that have the express intent of maintaining all management options for the future and of stimulating the development of late-mature and old-growth seral stages (the old-growth stage is currently below the recommended management range on the landscape of the south zone). These treatments would move stands selected for treatment along the pathway to older and larger seral stages and understory reinitiation, but would not alter the current distribution of seral or development stages (also called structural stages) within the analysis area.

Low thinning is a thinning method that involves removal of trees from lower canopy positions (overtopped, intermediate, and sometimes codominant), retaining the largest and most vigorous trees with the best-developed crowns. One objective of a low thinning is to salvage anticipated natural mortality losses by cutting smaller trees that are expected to die as the stand develops. This type of thinning closely mimics the natural course of stand development as it eliminates the trees least likely to grow into the dominant or codominant crown classes. Thinning reduces the stand density of trees to improve growth and yield, enhance stand health, and reduce potential mortality. Low thinning reduces competition between conifer trees for onsite resources such as light, water, and nutrients. Stand density varies, but stands selected for thinning are typically well stocked or overstocked and have sufficient density to respond to thinning.

With the exception of Douglas-fir plantations, stands to be treated are 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 prescribed for even-aged Douglas-fir plantations would reduce competition for growing space and reduce the amount of time needed to grow large trees.

On average, stands with early mature and mid-mature seral stages had tree densities that greatly exceeded desired stocking levels. The average relative density (RD) for early mature and mid-mature stages were 68 to 80 which is significantly above the desired levels of 30 to 50 RD (see Table 5). Thinning is needed to improve growth and yield, enhance stand health, and reduce potential mortality within these stands. Thinning early mature and mid-mature stands would not compromise long-term growth and yield at the stand or watershed level. Douglas-fir has been shown to respond to thinning even as old-growth trees.

Thinning from below would maintain the early mature and mid-mature seral stages within those stands treated to be within desired stocking levels. It would also promote trees in these younger stands to develop larger average sizes and longer and wider crowns, and create stands with more vertical structure and understory diversity. The health of black oaks would also be promoted. Thinning from below would maintain all future management options within treated stands, including regeneration harvest.

Proposed thinning treatments would promote resiliency to disturbance. Thinning would improve the ability of these stands to withstand the typical winter wind, ice, and heavy snowstorms that occur in this area, 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.

In summary, the proposed silvicultural prescription of low thinning or thinning from below would promote stands towards more diversity and reduce potential for lethal fire effects within the areas treated. These beneficial effects would be limited in extent because treatments could not be applied to areas where there were environmental constraints such as within high-quality northern spotted owl habitat and core areas, unsuitable soils, lack of road access, and riparian reserves. For example, approximately 67 percent of the project area is within the early mature and mid-mature seral stages, but only 37 percent of these areas would receive silvicultural treatments.

Alternative 3 - Regeneration Harvest

The silvicultural treatments and effects on vegetation would be the same as Alternatives 4 and 5 with the exception that Alternative 3 contains a limited number of regeneration harvest with green-tree retention acres and the total acres treated is slightly less. The primary difference between these alternatives is the logging systems used, which would result in fewer roads being needed for Alternative 4. The environmental effects caused by a change in logging systems will be discussed in detail in the economic, soil, and watershed discussions. Since the effects of

silvicultural treatments on forest health and resilience to disturbance for areas treated outside of regeneration areas are discussed under Alternatives 4 and 5, the following discussion will be limited to the effects regeneration harvest may have on vegetation and commodity outputs.

Silvicultural Treatments

A total of 205 acres within 28 treatment units would be treated with a regeneration harvest (see Table 67, Appendix A). Stands that would receive regeneration treatments are even-aged stands that are typically understocked or overstocked. Many of the understocked stands in the project area have been selectively harvested in the past and are not growing at optimum rates. Overstocked stands have too many trees per acre and growth is declining. The majority of the trees in this type of stand typically have poor crowns due to inter-tree competition and are no longer growing to the stand's potential.

Direct and Indirect Effects

Recommended Management Ranges - As discussed under *"Forest Plan Direction"* the Forest will manage within the recommended management ranges at the landscape scale (south zone). Smaller scales within each zone may not be within the recommended management range; however, the objective will be to still meet the recommended management range. There are no recommended management ranges for the shrub/forb or pole seral stages.

The Forest Plan states that stand regeneration harvest may be used where vegetation seral stage numbers indicate current conditions are in excess of the recommended management range (Table 8). However, the Forest Plan also states that stand regeneration should be limited only in areas where current conditions are below the recommended management range. Current conditions are at the upper end of the recommended management range at both the project and the south zone scales (Table 8).

Thinning, as prescribed for all alternatives, would not change the vegetation seral stage. A regeneration treatment is the only treatment that would change one seral stage to another. Regeneration harvest proposed on 205 acres would increase the shrub seral stage from the current 6 percent to 8 percent, and slightly decrease the amount in early mature and mid-mature by 1 percent within the project area. The 1 percent decrease in early mature and mid-mature seral stages caused by regenerated acreage would be so small it would not change the mix of seral stages at the south zone landscape level. Proposed regeneration harvest would not be creating an overabundance of shrub/forb and pole stages, nor compromise the ability to meet the recommended management range for old growth in the future and would be consistent with the Forest Plan.

Table 8. Seral stages within the project area and south zone, and recommended management ranges (RMRs) for the south zone

Seral stage	Acres within project area (% of total)	Post treatment acres (% of total)	South zone seral stage percentages[1]	South zone RMRs
Shrub	557 (6%)	762 (8%)	5	N/A
Pole	400 (4%)	400 (4%)	9	N/A
Early-mature (EM)	3,626 (39%)	3,505 (38%)	34	16 to 35
Mid-mature (MM)	2,977 (32%)	2,893 (31%)	30	25 to 35
Late-mature (LM)	1,392 (15%)	1,392 (15%)	14	9 to 14
Old growth (OG)	337 (4%)	337 (4%)	9	11 to 20

1 Change in acres within project area will have no change on the pre-treatment south zone seral stages.

Cumulative Effects (Vegetation)

Alternative 1 – No Action

Within the project 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 recommended management range for the old-growth stage. The no action alternative would have no effect on the current distribution of these stages in the next 20 to 30 years. After 20 to 30 years, it is expected that many of the mid-mature stands would begin to move into the late-mature stage (understory reinitiation) as a result of inter-tree competition and natural disturbances.

Alternatives 3, 4, and 5

With the exception of the 205 acres of regeneration in Alternative 3, all acres are treated the same and will be discussed in common. Regeneration will be discussed separately under Alternative 3.

Past Actions and Their Effect on Current Conditions

As mentioned above under Existing Condition, past timber harvest in the south zone has resulted in an altered distribution of seral stages compared to 60 years ago, when active timber harvest began. Since these stands have been affected by fire suppression, they are now thought to not be representative of most natural stand development processes under a frequent low-severity to mixed-severity fire regime.

The proposed actions differ from past actions in that previous timber harvest (with the exception of some recent commercial thinnings and selection harvest) consisted of clearcut or shelterwood logging, broadcast burning, and planting with Douglas-fir and ponderosa pine 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 of the south zone. These treatments would move these stands along the pathway to mid-mature/late-mature and understory reinitiation over time, but would not alter the current distribution of seral or development stages (also called structural stages) within the analysis area.

Similar thinning projects are being carried out within this watershed. The Little Doe/Low Gulch Timber Sale has been awarded and the Kelsey Peak Project is currently being planned. Other foreseeable actions within the project 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.

In terms of past, proposed, ongoing, and foreseeable actions, this project would have no cumulative effects to the vegetation structural stages within the south zone. The current distribution has been molded by past activities and wildfires, which removed older forest types. 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.

Alternative 3 - Regeneration Harvest

The regeneration harvest in this alternative would reduce the early-mature stage in the south zone from 33.5 percent to 33.4 percent, and the mid-mature from 29.8 percent to 29.7 percent; both of these values are within the recommended management range. There is currently 13.2 percent of the zone in the shrub/forb and pole stages, and this would increase to 13.4 percent with the addition of 205 acres of regeneration harvest. The shrub/forb and pole stages could be thought of as future “replacement” for the early-mature stage, which has a low end of the recommended management range of 16 percent. Given these figures, this alternative would be consistent with recommended management ranges and would not be creating an overabundance of shrub/forb and pole stages, nor compromise the ability to meet the recommended management range for old growth in the future. Also, this alternative would still promote 2,177 acres of early- and mid-mature stands towards later seral stages through thinning, and this represents approximately two percent of the Douglas-fir series in the south zone.

Fuels

Affected Environment

Fire History and Occurrence

Fire is a key ecological process in the northern California. Prior to the twentieth-century fire suppression era, human and lightning caused fires burned throughout Northern California exhibiting both low and mixed severity (Peterson et al. 2005 and Agee 2001). Lightning, along with the activities of Native Americans, miners, trappers, and settlers, all influenced the structure and condition of the vegetation throughout the landscape through the use of fire (Agee 1993 and Taylor 2003).

Historically, frequent low- to moderate-intensity fires suppressed the regeneration of fire-sensitive plant species, supported fire-tolerant plant species, and maintained a variety of forest structures including a higher proportion of low-density stands than currently exists (Peterson et al. 2005). These historic fires exhibited a wide range of fire intensities with the majority of the fires

in the low to moderate category and some with high, stand-replacement intensity resulting in a mosaic pattern of vegetation on the landscape (Agee 1993). With the onset of fire suppression in the planning area between 1930 and 1945, fire frequency has declined and changes to the vegetation structure have led to a denser, more homogeneous forest (Sugihara et al. 2006). Between 1970 and 2007, there have been 22 wildland fires scattered throughout the planning area. Of these 22 fires, 13 were caused by lightning and the remaining 9 were caused by human actions. The fire sizes ranged from less than 1 acre to 41 acres.

Vegetation

The forested portion of the planning area mainly consists of rather uniform, even aged stands of Douglas-fir with a dense understory and higher than normal fuel loadings .California black oak Pacific madrone, canyon live oak, and Oregon white oak are the predominant hardwood species within the planning area. Fire and other disturbances have greatly influenced these general forest types and the lack of more frequent , low to moderate-intensity stand-maintenance fires have increased the likelihood of uncharacteristic, infrequent, high intensity, stand replacement wildfire (Peterson et al. 2005 and Sugihara et al. 2006).

Potential Fire Behavior

Fireline intensity is widely used as a means to relate visible fire characteristics and interpret general suppression strategies. There are several ways of expressing fireline intensity. A visual indicator of fireline intensity is flame length (Rothermel 1983). Table 9 compares fireline intensity, flame length, and fire suppression difficulty interpretations.

Fire types (categorized by surface fire, passive crown fire, and active crown fire) are also widely used to determine strategies and tactics to maximize the safety of both firefighters and the public.

Table 9. Fireline intensity interpretations

Fireline intensity	Flame length	Interpretations
Low	< 4 feet	Direct attack at the head and flanks with hand crews; handlines should stop spread of fire
Moderate	4-8 feet	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to stop fire spread. Equipment such as dozers, engines, and retardant aircraft can be effective.
High	8-11 feet	Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the fire head likely ineffective. This fire would require indirect attack methods
Very high	> 11 feet	Crowning, spotting, and major fire runs are probable; control efforts at the head are likely ineffective. This fire would require indirect attack methods

Table based on Rothermel (1983)

A fire modeling assessment was conducted to evaluate the existing potential of fireline intensity and relative hazard rating (expressed in flame length) and existing potential crown fire ratings for the project area as well as the proposed treatment area under high fire danger (90th

percentile) weather conditions (see Fuels Report for model assumptions). Results of these modeled outcomes are summarized in Tables 12 – 15.

Based on the fire modeling assessment, approximately 63 percent of the entire project area currently could generate flame lengths over 4 feet (Table 10) making it necessary to utilize mechanized equipment, including aircraft, for suppression activities.

Within the treatment units, approximately 58 percent of the area currently could generate flame lengths over 4 feet (Table 11).

Table 10. Project area – existing condition – fireline intensity

Flame length	Fireline intensity hazard rating	Percent of area
< 4 feet	Low	36
4.1 - 8 feet	Moderate	5
8.1 - 11 feet	High	3
> 11 feet	Very High	55
Non-Vegetated	--	1
Total		100

Table 11. Treatment units – existing condition – fireline intensity

Flame length	Fireline intensity hazard rating	Percent of area
< 4 feet	Low	41
4.1 - 8 feet	Moderate	2
8.1 - 11 feet	High	2
> 11 feet	Very High	54
Non-Vegetated	--	1
Total		100

Approximately 60 percent of the *project area* is expected to experience passive crown fire (torching) or active crown fire (Table 12), making control efforts less effective and more hazardous to firefighters and the public.

Within the *treatment area*, approximately 59 percent of the area could experience passive crown fire (torching) or active crown fire (Table 13), making control efforts less effective and more hazardous to firefighters and the public.

Table 12. Project area – existing condition – potential crown fire

Potential crown fire class	Percent of area
Non-vegetated	1
Surface Fire	39
Passive Crown Fire	50
Active Crown Fire	10
Total	100

Table 13. Treatment area – existing condition – potential crown fire

Potential crown fire class	Percent of area
Non-vegetated	<1
Surface Fire	41
Passive Crown Fire	51
Active Crown Fire	8
Total	100

Environmental Consequences

Methodology

A landscape file suitable for use in FARSITE and FlamMap was provided by the Pacific Southwest Region (R5) of the Forest Service. Fuel models as defined by Scott and Burgan (2005) were used as a measure to display general changes in fuel profiles by vegetative cover type. Models were adjusted using best professional judgment and through consultation with district and TEAMS Enterprise personnel in order to most accurately represent fuels for the project area. Fuel models were then processed through a fire behavior model (FlamMap) to determine fire behavior characteristics (see Fuels Report).

Assumptions and Variables Used In the Models:

Weather parameters used in the models represent the 90th percentile weather conditions for the area. These values were derived from the Ruth Remote Automated Weather Station located near the analysis area over a 38-year period from June 1 through October 31 and represent the period when most wildfire ignitions occur (Curran 2008).

Ninetieth percentile wind speed for the area is approximately 8 miles per hour. The fuel moisture values used were as follows:

- 0 to 0.24-inch (1 hour) dead twigs = 3 percent
- 0.25- to 0.99-inch (10 hour) dead twigs = 4 percent
- 1.0- to 2.99-inch (100 hour) dead twigs = 9 percent;

- 3+-inch (1,000 hour) = 11 percent
- herbaceous fuels = 30 percent
- live woody fuels = 70 percent

Spatial and Temporal Context for Effects Analysis

Direct and indirect effects to the fire and fuels resource was assessed within the treatment units of the Beaverslide Project. Cumulative effects assessed actions within the project area boundary of the Beaverslide Timber Sale and Fuel Treatment Project. Short-term effects are those conditions following treatment. Long-term effects reflect those conditions that would potentially exist 10 years after treatment.

Direct and Indirect Effects

Alternative 1 – No Action

Effects on Potential Fire Behavior - Under the no action alternative, potential fire behavior initially in 36 percent of the project area would be in the low category (less than 4-foot flame lengths) and 55 percent of the project area would be in the very high category (greater than 11-foot flame lengths) as described under the existing condition. However, this would change as surface and ladder fuels continue to develop and dead fuels continue to accumulate. This accumulation of excess fuels would cause more acres to move to the moderate, high, and very high potential fire behavior categories, which would continue to increase the risk to public and firefighter safety in the event of a wildfire. Under these conditions, future fire suppression capabilities would be reduced and could lead to more acres burned and increased risk to communities in the area.

Effects on Crown Fire Potential - Initially, 39 percent of the project area would support surface fires, 50 percent of the area would support passive crown fires, and 10 percent would support active crown fires. Under the no action alternative, the vegetation and related fuel strata would continue to grow, increasing the canopy cover and the crown bulk density, both key components of determining crown fire potential. In addition, ladder fuels and surface fuels would continue to accumulate causing more of the area to move into the passive and active crown fire categories.

Summary of Effects

Under this alternative, fuel loadings would not be reduced resulting in increased potential fire behavior expressed in flame length (fireline intensity). In addition, a reduction in the canopy cover and the crown bulk density, both key components of determining crown fire potential, would not be realized. The ability of firefighters to safely and effectively suppress wildland fire would become more difficult as fire behavior characteristics intensify. The selection of this alternative would not contribute to the purpose and need of the Beaverslide Timber Sale and Fuel Treatment Project, LRMP direction, or respond to the National Fire Plan goals of reducing hazardous fuels to modify current fire behavior.

Cumulative Effects

No cumulative beneficial effects would occur with the selection of the no action alternative. This alternative would not contribute to the reduction in potential fire behavior and potential crown fire.

Alternatives 3, 4, and 5

The difference in the number of acres treated as well as the treatment types in Alternatives 3 and 4 are not significantly different from Alternative 5 from the perspective of the fire and fuels resource. Therefore the effects on potential fire behavior or potential crown fire ratings of Alternative 5 is assumed to be the same as Alternatives 3 and 4 and the following discussion will be for all action alternatives.

Effects on Potential Fire Behavior - The revised proposed action would reduce the potential fire behavior in most of the treatment area to the low category, which would decrease risk to public and firefighter safety in the event of a wildland fire. Based on the fire modeling assessment, 80 percent of the treatment area would generate flame lengths under 4 feet (Table 14) allowing hand crews to directly attack fires. This reflects a 39 percent increase of acres into the low category and a 42 percent reduction of acres out of the very high category. Under these conditions, fire suppression capabilities are enhanced and public safety is increased.

Table 14. Treatment units – no action vs. revised proposed action – fireline intensity

Flame length	Fireline intensity hazard rating	Percent of area no action	Percent of area revised proposed action	Percent increase or decrease (-)
< 4 feet	Low	41	80	39
4.1 - 8 feet	Moderate	2	5	2
8.1 - 11 feet	High	2	3	1
> 11 feet	Very High	54	12	- 42
Non-Vegetated	--	1	<1	0
Total		100	100	

Effects on Crown Fire Potential - The revised proposed action would reduce the crown fire potential in most of the treatment area to the surface fire category, which would decrease risk to public and firefighter safety in the event of a wildland fire. Based on the fire modeling assessment, 76 percent of the treatment area would support surface fires (Table 15) that would allow hand crews, equipment, and aircraft to be successful in fire suppression efforts. This reflects a 35 percent reduction of acres moving from the active crown fire category as well as the passive crown fire category into the surface fire category.

Table 15. Treatment units – no action vs. revised proposed action – potential crown fire

Potential crown fire class	Percent of area no action	Percent of area revised proposed action	Percent increase or decrease (-)
Non-vegetated	1	1	0
Surface Fire	40	76	35
Passive Crown Fire	51	22	- 28
Active Crown Fire	8	1	- 7
Total	100	100	

This alternative involves pile burning and jackpot burning, which always carries some degree of risk of a fire escape resulting from unforeseen factors such as adverse changes in weather. However, all treatments using management-ignited fire require the development of a prescribed fire plan that must follow all Federal, State, and local laws and regulations. A well-prepared, well-executed prescribed fire plan would minimize the risk of fire escape.

Summary of Effects

Under any of the action alternatives (3, 4 or 5), there would be a substantial reduction in flame lengths greater than 4 feet as compared with the no action alternative. There would also be a substantial reduction in crown fire potential as compared with the no action alternative. The ability of firefighters to safely and effectively suppress wildland fire would be improved. The selection of this alternative would contribute to the purpose and need, the desired condition, LRMP direction and respond to the National Fire Plan goals of reducing hazardous fuels to modify fire behavior.

Cumulative Effects

Past events and activities have shaped the existing condition of the project area. Active fire suppression has contributed to the dense forest and excess fuel conditions that exist throughout the project area. The selection of any of the action alternatives would have beneficial cumulative effects in the treatment areas by substantially reducing potential fire behavior and crown fire potential, creating conditions where safe suppression operations may be implemented.

Wildlife

Affected Environment - Threatened, Endangered, and Proposed Species

Possible species that may occur within the Beaverslide Project area was determined by first consulting the U.S. Fish and Wildlife Service (USFWS) interactive web site[2] to obtain a list of species that may occur in Trinity County and then consulting a forestwide Biological Assessment and Evaluation (BA/BE) that was last revised in February 2008. This BA/BE encompassed both the USFWS species list and the Pacific Southwest Region's Sensitive Species List. Federally

[2] http://www.fws.gov/arcata/specieslist/search.asp

listed species that may be found within the Beaverslide project area and the determination of effects for all action alternatives is presented in Table 16. The northern spotted owl is the only listed species that occurs in the Beaverslide project area, which will be discussed in detail in this section. Informal consultation with U.S. Fish and Wildlife Service is nearing completion and a concurrence is expected. None of the action alternatives would affect the marbled murrelet; therefore, no discussion will occur (for additional information see the BA/BE). The two sensitive species on this project are Pacific fisher and yellow-billed cuckoo. Of these two candidate species, the Pacific fisher will be discussed as a sensitive species. There would be no effect from any of the action alternatives on the western yellow-billed cuckoo; therefore, it will not be discussed.

Table 16. Federally listed wildlife species analyzed for the Beaverslide Project

Species	Status	Determination of effect (all action alternatives)
Northern spotted owl (*Strix occidentalis caurina*)	Federally threatened	May affect but not likely to adversely affect. There is no critical habitat.
Marbled murrelet (*Brachyramphus marmoratus*)	Federally threatened	No effect. There is no critical habitat.
Western yellow-billed cuckoo (*Coccyzus americanus*)	Federal candidate	No effect.
Pacific fisher (*Martes pennanti pacifica*)	Federal candidate	May impact individuals but will not appreciatively diminish recovery options.

Northern Spotted Owl

The Northern Spotted Owl Recovery Plan was recently finalized and continues to recognize the importance of maintaining habitat for the recovery and long-term survival of the spotted owl. The Recovery Plan relies on Federal lands to provide the major contribution for recovery. In the western physiographic provinces, managed owl conservation areas (MOCAs) are recommended to provide habitat for the recovery of the owl. The managed owl conservation area network is intended to support a stable number of breeding pairs of spotted owls over time and allow for movement of spotted owls across the network. Outside of managed owl conservation areas, substantially all older and more structurally complex multi-layered conifer forest on Federal lands are to be maintained. In the California Klamath Province, the Recovery Plan calls for an adaptive management approach to fire management and spotted owl recovery (USDI Fish and Wildlife Service 2008).

The northern spotted owl life history, ecology, and habitat characteristics are discussed in detail within the Recovery Plan. The Service uses a 0.7-mile radius (984 acres) analysis area from the activity center to delineate the most heavily used area during the nesting season. Northern spotted owl territories with at least 500 acres of suitable nesting/roosting habitat within 0.7 mile and 1,340 acres within 1.3 miles of the nest tree are more likely to be reproductively successful. The amount of available foraging habitat is also a variable to be considered when determining the relative health of a territory.

Northern Spotted Owl Status within the Beaverslide Project Area - There are 11 northern spotted owl territories within the Beaverslide project area (Table 17 and Figure 2). Territories overlap each other and cover most of the project area. Four out of the 11 territories were occupied by a northern spotted owl pair when last surveyed in 2008. Additional surveys will be conducted in 2009. Each territory contains a 70-acre nest grove consisting of the best nesting/roosting habitat. Territories 6 and 7 have 100-acre late successional reserves (LSRs).

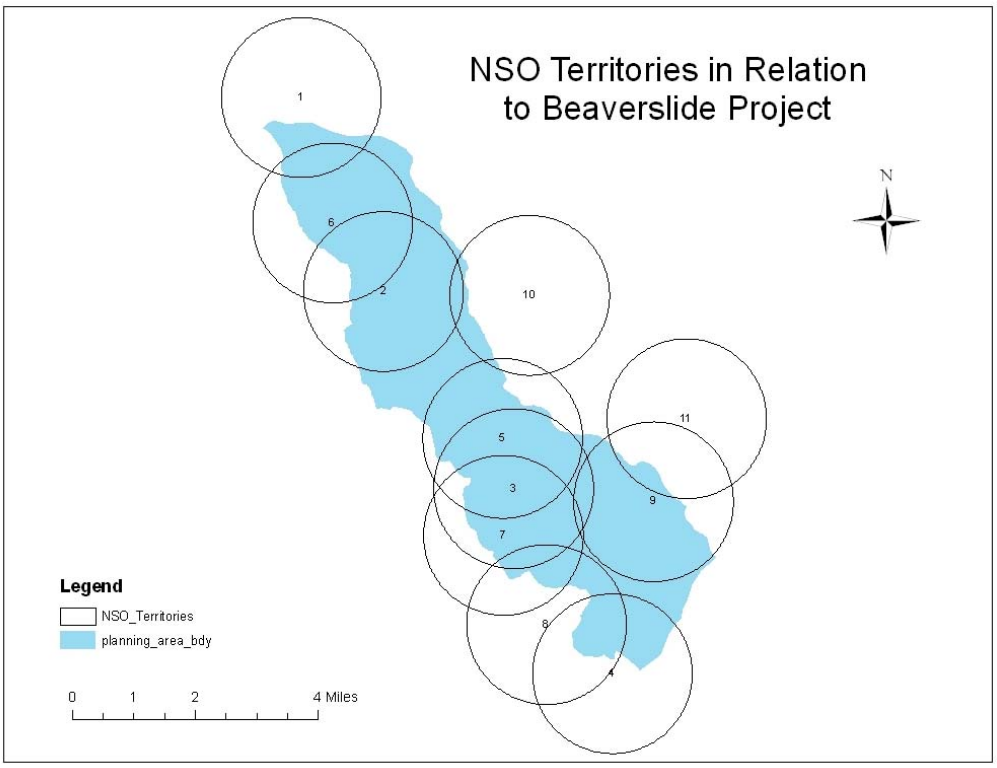

Figure 2. Northern spotted owl (NSO) territories (1.3-mile buffer around center) associated with the Beaverslide Project

Table 17. Northern spotted owl territories within or adjacent to the Beaverslide project area

No.	Territory name	Last year found	Land allocation	Reproductive status
1	Tompkins	2008	Matrix	Single
2	Van Horn	2008	Matrix	Pair
3	Little Field Creek	2008	Matrix	Pair
4	Hayden	2008	Matrix	Pair
5	Double A Ranch	2008	Matrix	Single
6	Lynch Creek	2008	LSR	Single
7	Strongarm	1993	LSR	Pair
8	Hayden West	1993	Matrix	Pair
9	Mad River	2008	Matrix	Pair
10	Ruth Airport	1989	Matrix	Single
11	Barry	1983	Matrix	Single

Table 18 summarizes, by territory, the amount of nesting/roosting and foraging habitat within 0.7 and 1.3 miles of the known activity centers within the project area. No designated critical habitat occurs within the Beaverslide project area.

Table 18. Acres of northern spotted owl habitat within each territory associated with the Beaverslide Project

Territory No.	Territory name	Acres of nesting/roosting habitat			Acres of foraging habitat		
		Acres N/R 0-0.7 miles	Acres N/R 0.7-1.3 miles	Total acres N/R 0-1.3 miles	Acres foraging 0-0.7 miles	Acres foraging 0.7-1.3 miles	Total acres foraging 0-1.3 miles
1	Tompkins	481	546	1,027	190	807	997
2	Van Horn	345	410	755	448	1251	1699
3	Little Field Cr	317	841	1,158	293	723	1016
4	Hayden	543	693	1,236	80	488	568
5	Double A Ranch	461	599	1,060	229	860	1089
6	Lynch Creek	363	573	936	431	936	1367
7	Strongarm	328	596	924	258	561	819
8	Hayden West	389	783	1,172	76	468	544
9	Mad River	112	548	660	498	795	1,293
10	Ruth Airport	196	32	728	466	943	1,409
11	Barry	156	563	719	371	756	1,127

N/R = nesting/roosting

Environmental Consequences - Threatened, Endangered, and Proposed Species

The direct and indirect effects that may be caused by the action alternatives on threatened, endangered, proposed, and candidate species were discussed in detail in the BA/BE and the Wildlife Report with both documents being referenced in their entirety.

The marbled murrelet and the western yellow-billed cuckoo will not be discussed further because there would be no impact from any of the action alternatives due to the following:

- the project area is outside of the range of the species,
- the species were not detected during formal surveys,
- there are no historical records of the species on the Mad River Ranger District, and
- proposed activities would not occur within or adjacent to suitable or designated critical habitat.

Northern Spotted Owl

Alternative 1 (No Action) – Direct and Indirect Effects

There would be no direct effects to the northern spotted owl with the implementation of the no action alternative because no timber harvest and associated management activities would occur. However, an indirect effect would be the result of no treatments of younger, single-storied stands

and therefore, no improvement in habitat conditions through the acceleration of late-successional habitat characteristics. As stands continue to grow, risk of wildfire would increase (for a greater discussion of Alternative 1 indirect effects on vegetation and fuels, see Vegetation and Fuels sections).

Alternatives 3, 4 and 5 – Direct and Indirect Effects

The vegetation and fuel treatments are the same for all action alternatives, except Alternative 3 proposes regeneration harvest with legacy-tree retention on 205 acres and the total acres treated (thinned) is 89 less acres within the riparian reserves. Regeneration units that overlapped riparian reserves had that part within the riparian reserves dropped from treatment. Therefore, environmental consequences for all treatments other than regeneration will be discussed in common for all action alternatives (including Alternative 3) followed by a discussion of environmental consequences for regeneration.

Table 19 summarizes the quantity of suitable nesting/roosting and foraging habitat potentially affected by commercial harvest by alternative. In many cases, territories overlap each other (see Figure 2) and the following table presents acres potentially affected without any overlap.

There are 11 northern spotted owl activity centers located within the Beaverslide project area. Some of these territories overlap considerably therefore some proposed harvest units occur in more than one territory. There are about 3,228 acres of northern spotted owl nesting/roosting habitat within the 11,796-acre project area. The alternatives propose to thin 301 acres of nesting/roosting habitat in Alternatives 3 and 330 acres in Alternatives 4 and 5 (see Table 19). This equates to about 9 percent in Alternative 3 and 10 percent in Alternatives 4 and 5. Table 20 identifies the acres of nesting/roosting northern spotted owl habitat that would be treated and the percentage of the total within each territory for all action alternatives. Territories overlap, and therefore acre totals will not equal total treated acres in Table 19, but the table provides a clearer picture for each territory. No regeneration treatments would occur within nesting/roosting habitat. No regeneration harvest would occur in any type of habitat within 0 to 0.7 mile of the activity center. Regeneration with green tree legacy would occur within foraging habitat from 0.7 to 1.3 miles of center.

Table 19. Acres of northern spotted owl nesting/roosting and foraging habitat potentially affected within 11 territories

	Alternative 1		Alternative 3		Alternative 4		Alternative 5	
Treatments	**N/R**	**Foraging**	**N/R**	**Foraging**	**N/R**	**Foraging**	**N/R**	**Foraging**
Commercial thinning	0	0	301	1,470	330	1,702	330	1,702
Regeneration	0	0	0	165	0	0	0	0

N/R = nesting/roosting

Table 20. Acres of northern spotted owl nesting/roosting habitat thinned with associated fuels treatments[1] within nesting/roosting habitat for each territory, by alternative, Beaverslide project area

Territory No.	Territory Name	Alternative 3		Alternatives 4 & 5	
		Thinned 0-0.7 mile (%)	Thinned 0-1.3 mile (%)	Thinned 0-0.7 Mile (%)	Thinned 0-1.3 Mile (%)
1	Tompkins	1 (0.2%)	24 (2.3%)	1 ac (0.2%)	24 (2.3%)
2	Van Horn	6 (1.7%)	54 (7.1%)	6 ac (1.7%)	61 (8.0%)
3	Little Field Creek	0.2 (0.1%)	22 (1.9%)	0.2 ac (0.1%)	28 (2.4%)
4	Hayden	4 (0.7%)	16 (1.5%)	4 ac (0.7%)	17 (1.4%)
5	Double A Ranch	2 (0.4%)	16 (1.5%)	2 ac (0.4%)	27 (2.5%)
6	Lynch Creek	22 (6.1%)	64 (6.8%)	23 ac (6.3%)	72 (7.7%)
7	Strongarm	16 (4.9%)	25 (2.7%)	16 ac (4.9%)	31 (3.4%)
8	Hayden West	3 (0.8%)	21 (1.8%)	3 ac (0.8%)	22 (1.9%)
9	Mad River	0	150 (23.0%)	0	151 (23.2%)
10	Ruth Airport	0	0	0	0
11	Barry	0	4 (0.6%)	0	4 (0.6%)

1 Fuel treatments consist of jackpot burning to reduce residual thinning slash.

The USFWS has concluded that northern spotted owl productivity and survivorship are reduced when the proportion of suitable (nesting/roosting) habitat within 0.7 mile of an activity center falls below 500 acres (50 percent) and the proportion of suitable habitat within a home range (3,300 acres or 1.3-mile radius) falls below 1,336 acres (40 percent; USDI Fish and Wildlife Service 1990). All of the activity centers are deficit in suitable nesting/roosting habitat within both the 0.7-mile range and the 1.3-mile range with the exception of one, Activity Center (AC) 5, which is above the threshold in the 0.7 radius, but is deficit within the 1.3-mile range. There would be no reduction of nesting/roosting habitat with the exception of the loss caused by roads and landings (Table 19). Fuels corridor treatments would not remove any nesting/roosting habitat for northern spotted owl as these corridors occur primarily along roads and on ridgetops.

There would be no removal of habitat because of thinning. The only removal of habitat would be as a result of new temporary roads and landings as reflected in Table 19 and the small amount of regeneration in Alternative 3. Reducing tree density, even when maintaining key habitat variables such as large old trees, may have a short-term negative effect on nesting/roosting habitat, but is expected to have a long-term beneficial effect. Because of this possible short-term effect, thinning is considered to have a degradation effect.

A total of 330 acres of nesting/roosting and 1,702 acres of foraging habitat are proposed to be commercially thinned. Timber harvest and associated management activities may negatively affect the northern spotted owl by removing and/or degrading suitable northern spotted owl habitat. Particular attention is focused on the potential impacts to nesting and roosting habitat because it is the most critical factor for the reproductive success of individual animals.

Low thinning is a thinning method that involves removal of trees from lower canopy positions (overtopped, intermediate, and sometimes codominant), retaining the largest and most vigorous trees with the best-developed crowns. This type of thinning closely mimics the natural

course of stand development as it eliminates the trees least likely to grow into the dominant or codominant crown classes. Thinning reduces the stand density of trees to improve growth and yield, enhance stand health, and reduce potential tree mortality. Thinning from below while maintaining a minimum of 60 percent canopy cover is the best management prescription to maintain and recruit the habitat variables critical to nesting/roosting habitat (e.g., large old trees and codominant and intermediate conifers with crown space in the canopy for crown development) while at the same time improving forest health and reducing risk to wildfire and insects and disease.

Through project design, high-quality nesting/roosting habitat was excluded from any treatments. A degradation analysis of marginal or low quality nesting/roosting habitat proposed for commercial thinning indicates that overall 1.5 percent within the activity center from 0 to 0.7 mile is proposed for thinning. At 0 to 1.3 miles (including acres treated from 0 to 0.7 mile) 4 percent of the acres and less than 1 percent of habitat would be removed. There may be a short-term negative effect to these habitats, but treatments would result in higher quality habitat over time.

Effects of Regeneration Harvest

Foraging habitat would be removed within 28 units. Nineteen of these units would treat less than 10 acres. Nine units would be equal to or greater than 10 acres with the largest unit being 25 acres. Regeneration harvest would retain legacy trees and have follow-up tree planting with the following retention guidelines:

- Generally, 70 percent of the area to be retained would be comprised of clumped legacy retention areas. To the extent possible, these legacy areas would represent the largest, oldest conifers in the stand and incorporate snags and down logs.
- The remaining 30 percent of the area to be retained would leave legacy trees dispersed as individual trees or small clusters of trees. An average of two to four trees per acre would be retained outside of legacy retention areas. Distribution patterns would vary depending on factors such as incidence of disease, wind throw hazard, regeneration capability, and additional wildlife needs. To the extent possible, the largest, oldest conifers would be retained.
- Regeneration treatments would not occur in northern spotted owl nesting/roosting habitat, riparian reserves, or in late-mature or old-growth stands. No regeneration harvest would be located within the 0.7-mile radius of any home range core of northern spotted owl territories. Out of 205 acres, approximately 165 acres of foraging habitat would receive regeneration treatments (Table 19) and would be lost by removal of most of the overstory trees. This amount would be only 3 percent out of the total 4,878 acres of foraging habitat available throughout the planning area. The remaining 40 acres are currently unsuitable owl habitat made up of early mature forests.

Many territories overlap so the total (if added together) will be greater than the actual 165 acres, however for analysis purposes it is necessary to accurately view how each activity center could be potentially affected.

With the small size of the units, many of these treatments would be more like small openings than the traditional clearcuts. Recent landscape-level analyses in portions of Oregon Coast and California Klamath Provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests. There is little evidence that small openings in forest habitat influence the dispersal of spotted owls (USDI Fish and Wildlife Service 2008). Retention guidelines should maintain the prey base in developing young stands, especially dusky-footed woodrats and flying squirrels, potentially leading to foraging and roosting use by northern spotted owls. Limited regeneration harvest on small areas may therefore have a positive effect on the prey base. One recommendation has been to have 10 percent of a home range in openings from recent regeneration harvest (USDI Fish and Wildlife Service 2006).

Table 21. Amount of regeneration treatment within foraging habitat within 0.7 to 1.3[a] miles of the center of each northern spotted owl territory

Activity center number	Acres of regeneration	Percent of available foraging habitat
1	0	N/A
2	51	3%
3	45	4%
4	39	7%
5	39	4%
6	57	4%
7	24	3%
8	34	6%
9	29	2%
10	0	N/A
11	0	N/A

a There are no regeneration treatments within 0 to 0.7 mile; therefore, this table reflects only 0.7 to 1.3 miles

Effects of Other Activities

Other treatment activities consist of jackpot burning outside of commercial units, brush mastication, creation of fuel corridors, new road construction (temporary roads), and new helicopter landings (see Table 22).

Fuel corridors would be created along major roads to create a defensible space and safe access to assist in firefighting efforts. These roads are found within northern spotted owl territories, some close to the center of the territory. Most roads are along ridgetops; however, they do intersect nesting/roosting habitat. The amount ranges from 0 to a high of 11 percent in Territory 5. 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 some trees 12 inches in diameter or less.

Where not restricted by spread of noxious weeds; mastication would occur to reduce dense shrubs. Timing restrictions, otherwise known as limited operating periods (LOP) would be applied to avoid disturbance to active nest sites. Brush fields generally are not considered northern spotted owl habitat, but may include inclusions of suitable habitat. Any change to nesting/roosting habitat is expected to be small with the change occurring totally in the understory; canopy cover would be maintained. Additionally, the reduction of forest fuels in these habitats would protect and maintain these stands as nesting/roosting habitat, which the Recovery Plan recommends.

Table 22. Other activities occurring in nesting/roosting habitat within 1.3 miles of an activity center

Territory	Jackpot burn acres (percent)	Mastication acres [a]	Fuel corridor [b] acres (percent)	New temporary roads acres
1	0	0	0	0.1
2	0	0	46 (6%)	2.2
3	84 (7%)	0	74 (6%)	0.3
4	31 (3%)	0	9 (0.7%)	0.6
5	39 (4%)	0	117 (11%)	0.02
6	0	5	78 (8%)	1.1
7	89 (10%)	0	23 (2%)	0.5
8	44 (4%)	0	11 (0.9%)	1.5
9 [c]	16 (2%)	3	19 (4%)	0.8
10	0	0	0.4	0
11	0	0	7 (1.0%)	0.2

a Mastication acres of brush only occur outside of fuel corridors. Most mastication would be within fuel corridors along roads. Fuel corridors include defensible space.

b Treatments to create corridors include thinning trees less than 12 inches in diameter, pruning, brush mastication, chipping (primarily), hand pile and pile burning (where chipping is not feasible).

c For territory 9 there would be no treatments within nesting/roosting habitat within 0 to 0.7 mile from center of territory.

The primary objective of using jackpot burning where there is commercial logging is to reduce the logging and fuel slash created by treatments. Jackpot burning would also be used within fuel treatment units and corridors. It is a low-intensity burn where scattered areas that have excessive fuels are ignited and then fire is allowed to move between concentrations at a very low intensity. In many cases, the interspaces will not burn due to a lack of fuels. The fire may consume seedlings and saplings, down logs, and occasionally standing snags; however, it would be limited due to the patchy distribution and low intensity of the fire. The reduction of ground fuels would reduce risk from wildfires by lowering flame lengths (see Fuels section). Most of the acres commercially thinned by territory (see Table 20) would also be jackpot burned. Thinning may have short-term effects by possibly changing the forest structure; however, burning to clean up logging slash is not expected to add cumulatively to the possible impacts of thinning from below (see discussion above). It is expected that fuel treatment units would receive jackpot burning only to reduce fire risk. Fuel corridors would receive jackpot burning to clean up any slash from mastication or fuels-reduction thinning that would be required to create fuel corridors and safe space for firefighting activities. Impacts to northern spotted owls and their habitat from

jackpot burning within fuel corridors is expected be slight because there would be no change in the mid-story and overstory forest structures and there would be minor losses of down logs and snags.

New landings (such as for helicopter use where mature trees are being removed) may have negative impacts to northern spotted owls. Skyline and tractor landings would be located within the roadbed themselves and no new clearings would be created. A small number of trees may be removed along cable lines in association with skyline landings for safety reason. There could be up to three new helicopter landings (see Proposed Transportation Maps, Appendix C). Helicopter landings have to be much larger than skyline and tractor landings and would require clearing. No helicopter landings are within nesting/roosting habitat. Two helicopter landings (Nos. 31 and 97) would be within foraging habitat. Helicopter landing No. 31 is within Territories 2 and 6 and helicopter landing No. 97 is within Territory 2. Both are within foraging habitat with the possible loss of approximately 0.9 acre (0.45 acre per landing). These may or may not be constructed based on the needs of the operator. Helicopter landing No. 20 is within Territory 3 but is within non-habitat and is not expected to have any impact on northern spotted owl habitat.

For Alternatives 3 and 5, new temporary roads would be constructed that would be closed following treatment. No new roads would be constructed under Alternative 4. When overlapping territories are taken into consideration, there are only 1.3 acres (total) of new roads within nesting/roosting habitat. Therefore, the loss of habitat due to the construction of new roads is very small.

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 Chapter 2 (see page 22).

Although operations conducted between July 9 and July 31 are not expected to disturb nesting adults, they have the potential to disturb newly fledged young. These activities are not expected to impact suitable northern spotted owl habitat; however, there may be some indirect impacts to northern spotted owl habitat from jackpot burning. 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 materials are usually of large enough diameter that the logs are not burned completely and continue to provide key habitat features such as refugia and escape cover. In the long term, reduction of fuel in the stands would improve stand resilience to fire disturbance, thus protecting northern spotted owl habitat in the long run.

Cumulative Effects to the Northern Spotted Owl

California Klamath Province - This analysis is for the California Klamath Province as described in the Northern Spotted Owl Recovery Plan (see Northern Spotted Owl Affect Environment). The Beaverslide project area is approximately 11,796 acres and is located on the east-facing slope on

the west side of the upper Mad River. The project area is surrounded by three managed owl conservation areas (MOCAs). The upper half of the project area has one to the east and one to the west, both approximately 2 miles away. The southern point of the analysis area is approximately 2.5 miles from one managed owl conservation area to the south (Figure 3). Two categories of managed owl conservation areas were identified: category 1 managed owl conservation areas have the capacity to support 20 or more reproducing pairs of spotted owls and category 2 managed owl conservation areas have the capacity to support 1 to 19 pairs. Wildfires in 2008 burned a significant portion of MOCA 52 to the east and MOCA 54 to the south. Information for each managed owl conservation area is described in Table 23 and the location of the managed owl conservation areas in relationship to the Beaverslide project area is shown in Figure 3.

Table 23. Managed owl conservation areas surrounding the Beaverslide project area

MOCA number	Category	Acres
51	1	60,163
52	2	42,977
54	1	116, 304
Total		219, 444

MOCA = managed owl conservation area

According to the recovery plan, USFWS emphasizes the following regarding high-quality nesting/roosting northern spotted owl habitat: “substantially all older and more structurally complex multi-layered conifer forest on Federal lands are to be maintained.” This project has been designed so that no stands that meet the above definition are included in the project area and none of the proposed actions would reduce the current habitat within the matrix because of the following:

- No late mature or old growth stands would be treated
- No high quality nesting/roosting habitat would be harvested
- Only 165 acres of regeneration is proposed within northern spotted owl foraging habitat within Alternative 3 and no regeneration treatments would occur within 0.7 mile of activity centers, late-successional groves, or riparian reserves. Total acres receiving regeneration would equate to less than 1 percent of early mature and mid-mature stands.
- Only 27 percent of all mid-mature stands where stand density exceeds desired condition within the project area would be treated to increase resiliency to natural impacts such as insects/disease and wild fire.
- Thinning would be limited to 301 acres of nesting/roosting habitat for Alternative 3 and 330 acres for Alternatives 4 and 5 within 1.3 miles of activity centers.

Figure 3. Locations of the nearest managed owl conservation areas (MOCAs) in relationship to the Beaverslide Project analysis area

Mad River Watershed - The known past, present and reasonably foreseeable activities within the analysis area include timber harvest, fire, road construction, grazing and recreation. The activities associated with timber harvest, road construction, wildfire, fire suppression and fuel-treatment activities may be contributing to the cumulative effects to northern spotted owl habitat. Logging began in the upper Mad River watersheds in 1963. As of 1998, approximately 16,026 acres had been harvested with 43 percent being treated with clearcuts converting later seral stages to a shrub/ford seral stage (USDA Forest Service 1998).

Northern spotted owls are yearlong residents and maintain individual territories. The average home range of the northern spotted owl is approximately 1.3 miles from the nest site, with the most activity occurring within 0.7 mile of the nest tree. The ridges and draws associated with watersheds create natural barriers between territories. Additionally, the Upper Mad River Watershed is a large watershed bordered by South Fork Mountain to the north and Mad River Ridge and Jones Ridge to the south. These ridges are many miles long and often exceed 5,000 feet in elevation. Northern spotted owls within the watershed are likely to disperse within the watershed as opposed to crossing the major ridges to disperse into an adjoining drainage. It is more likely they would disperse into the sub-watersheds associated with the Upper Mad River Watershed. There are approximately 25,178 acres of suitable northern spotted owl habitat within the Upper Mad River watershed.

The current conditions found within northern spotted owl territories associated with the Beaverslide analysis are the cumulative result of past disturbances caused by natural events or timber harvesting. Seven out of the 11 territories overlap the project analysis area by 50 percent or more. When only examining the white-fir and Douglas-fir series, the amount of acres degraded to “non-habitat” within the territories (both within and outside of project area) range from a low of 13 to a high of 26 percent (Table 24). Regeneration proposed on 205 acres in Alternative 3 would increase the shrub seral stage from 6 to 8 percent across the project area and slightly decrease the amount in early mature and mid-mature stands by 1 percent (see discussion under Vegetation section). Alternatives 4 and 5 would not increase the amount of non-habitat within any of the territories.

Reasonably foreseeable actions include all Forest Service activities in some stage of NEPA planning (see Six Rivers National Forest Schedule of Proposed Actions). The Kelsey Peak Project is planned in the near future and may impact some of the northern spotted owl territories affected by the Beaverslide Project. Project design will take into affect any impacts from the Beaverslide project and it is expected that the Kelsey Peak Project will have similar limitations to be in full compliance with the Forest Plan and Northern Spotted Owl Recovery Plan. Additionally there is a proposed project in the Buck Mountain area approximately 2 miles west of this project.

Table 24. Acres and percentages of non-habitat most likely created by past disturbances from natural events or timber harvesting

Territory No.	Non-habitat within project		Mixed conifer	N/R 0 - 1.3 miles	Foraging 0 - 1.3 miles	Non-habitat mixed conifer		Non-habitat other plant associations
1	628.9	(19%)	2,522	1,027	997	498	(20%)	874
2	2,716.5	(80%)	2,824	762	1,694	368	(13%)	572
3	2,910.5	(86%)	2,645	1,158	1,014	473	(18%)	751
4	894.95	(26%)	2,279	1,236	568	475	(21%)	1,117
5	2,636.2	(78%)	2,642	1,068	1,081	493	(19%)	754
6	2,267.3	(67%)	2,756	941	1,361	454	(16%)	640
7	1,992.2	(59%)	2,104	924	817	363	(17%)	1,292
8	1,082.1	(32%)	2,039	1,172	544	323	(16%)	1,357
9	2,094.0	(62%)	2,331	660	1,293	378	(16%)	1,065
10	328.5	(10%)	2,559	728	1,409	422	(16%)	837
11	148.6	(4%)	2,511	710	1,137	664	(26%)	885

N/R = nesting/roosting

The Little Doe/Low Gulch Timber Sale on the Mad River Ranger District was planned in 2006-2007. The sales in this project are sold; however, no harvesting has occurred. The Little Doe/Low Gulch Project, once implemented, will degrade 128 acres of northern spotted owl habitat through thinning. The Little Doe/Low Gulch Project is not in the same project area as the Beaverslide Project.

In 2000, approximately 240 acres of suitable northern spotted owl habitat on Federal lands were lost to high-intensity fire associated with the Journey Fire. The adjacent private lands lost about 13 acres of suitable northern spotted owl habitat. In 2008, wildfires occurred on the Mad River Ranger District. No fires were within the Beaverslide project area although one to the southeast was very close to the perimeter of the project area and approximately 5 acres were lost due to suppression efforts.

Road building, including temporary roads, is generally associated with timber harvesting and has occurred on Federal and private lands throughout the watershed. It is not known how much suitable northern spotted owl habitat has been affected by these activities. It is likely that some road building may continue to occur on private and public lands throughout the watershed.

Summary of Northern Spotted Owl Cumulative Effects - The above analysis on the 11 historic northern spotted owl territories within 1.3 miles of the proposed project has disclosed the direct and indirect effects associated with the Beaverslide Project. There would not be a cumulative loss of suitable northern spotted owl habitat with implementation of either Alternatives 4 or 5. About 324 cumulative acres of suitable nesting/roosting habitat would be thinned, with thinning limited to retaining a 60 percent canopy density, and maintaining the nesting habitat without degrading it to foraging habitat. This prescription may have short-term degradation effects but cumulatively would improve northern spotted owl habitat available in the watershed.

Alternative 3, with 165 acres of regeneration harvest in foraging habitat, would reduce the amount of early mature by 1 percent or less. Project design deliberately avoided nesting/roosting habitat (see Vegetation section and Schantz 2009). Selected sites in early mature stands would not be considered northern spotted owl habitat and stands selected within mid-mature would be considered marginal northern spotted owl habitat, at best. Therefore, Alternative 3, with associated thinning may have a short-term effect but cumulatively over the watershed, the effect would be so small as not to be measurable.

Sensitive Wildlife Species

Presence or absence of wildlife species in the project area is based on the known range of each species, habitat suitability, records in the Six Rivers National Forest Wildlife Sighting Database, the Upper Mad River Watershed Analyses, the Forest's Geographic Information System (GIS) vegetation and wildlife species layers, and incidental observations.

Possible sensitive species that may occur within the Beaverslide project area was determined by consulting a forestwide biological assessment and evaluation (BA/BE) that the Forest last revised in February 2008. This BA/BE encompasses the Pacific Southwest Region's Sensitive Species List. Sensitive species that may be found within the Beaverslide project area and the determination of effects for all action alternatives is presented in Table 25. Impacts to the species have been determined to be the same per each of the alternatives. Only species where there may be an impact will be discussed further in this section.

Table 25. Sensitive species that may occur or has habitat within the Beaverslide project area and determinations of impact

Species	Status	Determination of effect (all action alternatives)
Western Yellow-billed Cuckoo (*Coccyzus americanus*)	Federal Candidate	No impact
Bald Eagle (*Haliaeetus leucocephalus*)	Sensitive	No impact
Northern Goshawk (*Accipiter gentilis*)	Sensitive	May impact individuals but will not cause a trend towards federal listing.
American Peregrine Falcon (*Falco peregrinus anatum*)	Sensitive	No impact
Pacific Fisher (*Martes pennanti pacifica*)	Federal Candidate	May impact individuals but will not cause a trend towards federal listing.
American Marten (*Martes Americana*)	Sensitive	No impact
California Wolverine (*Gulo gulo luteus*)	Sensitive	No impact
Townsend's big-eared bat (*Corynorthinus townsendii*)	Sensitive	No impact
Western Pond Turtle (*Clemmys marmorata marmorata*)	Sensitive	May impact individuals but will not cause a trend towards federal listing.
Northern Red-legged Frog (*Rana aurora aurora*)	Sensitive	May impact individuals but will not cause a trend towards federal listing.
Foothill Yellow-legged Frog (*Rana boylii*)	Sensitive	May impact individuals but will not cause a trend towards federal listing.
Southern Torrent Salamander (*Rhyacotriton variegatus*)	Sensitive	No impact

Northern Goshawk – Affected Environment

Northern goshawks (goshawks) in northern California prefer mature and old-growth conifer forests that are at middle to high elevations, have relatively dense canopy closures, have usually little understory vegetation, are in close proximity to riparian corridors, and have flat or moderately sloping terrain. Interspersed meadows or other openings are also important. Moderate and high-quality habitats contain abundant large snags and logs that provide prey habitat and plucking perches. Suitable habitat is used synonymously for nesting, roosting and foraging habitat determinations.

Goshawks are yearlong residents and maintain individual territories, although some short-term migrations occur in severe winters. Territory size ranges from 0.6 to 15 square miles. Similar to the northern spotted owl, goshawks are territorial and are susceptible to disturbance during the breeding season. Goshawks are extremely defensive of their nest areas. Goshawks are so defensive of their nests they will dive at and strike intruders, including humans. This defensive behavior causes these birds to expend energy rapidly and could interfere with the reproductive success of the disturbed goshawks.

The project area encompasses 11,796 acres. Within this area, there are approximately 4,696 acres of suitable goshawk habitat (about 40 percent of the project area). The proposed units contain about 1,194 acres of suitable goshawk habitat, which equates to about 25 percent of habitat in the project area. Protocol surveys were conducted for Northern Goshawk in 2008. The determination of “may impact individuals, but will not cause a trend towards federal listing” is based on the best available information including the current surveys and the level of likelihood of species occupying territories and habitat within the project area. The life history information and range maps for each of the species analyzed in this document can be found in the California Natural Diversity Database (http://www.dfg.ca.gov/biogeodata/cnddb/) and the Forestwide Reference Document (2008).

During the 2008 northern spotted owl surveys, there were incidental sightings of goshawk, in two areas in particular. These areas will be visited again during the additional 2009 surveys to verify if occupancy is occurring. The 2008 survey identified the Deep Hollow Creek territory (ID#1) with an active nest within the project area. There are no other historic sites in the project area. Table 26 summarizes, by territory, the amount of suitable habitat within the primary nest zones and the foraging habitat zones associated with the known activity center within the Beaverslide project area.

Table 26. Acres of suitable northern goshawk habitat within the territory in Beaverslide project area

Goshawk ID	Territory name	Acres of habitat in primary nest zone (0 - 0.5 miles from nest)	Acres of habitat in foraging zone (0.5 - 1.0 miles from nest)	Total habitat (0-1.0 miles from nest)
1	Hollow Creek	207	444	651
Desired conditions [1]		200	900	1,100

1 Desired conditions with these acres are generally thought to be more likely to produce reproductively successful pairs (LRMP, p. IV-101).

Northern Goshawk – Environmental Effects

Direct and Indirect Effects

Timber harvest and associated management activities may negatively affect the northern goshawk by removing and/or degrading suitable habitat. The potential effects to this species are based on how many acres of suitable habitat may potentially be impacted by the proposed project activities.

No habitat would be removed under the proposed action. Thinned habitat is expected to remain suitable after the project (canopy closure 60 percent or greater). In addition, thinning prescriptions are expected to improve the quality of the habitat in the long term by accelerating the development of late-successional characteristics and removing the understory ladder fuels to improve stand resilience to fire and potentially eliminate the risk of a stand-replacing fire that would remove habitat. Opening the understory would also improve the ability of goshawks to maneuver through the stand in pursuit of prey.

Goshawks may be susceptible to disturbance during the breeding season. A limited operating period for logging, hauling, and burning from March 1 to August 31 would preclude noise- and smoke-generating activities within a 200-acre area around goshawk territories (see Chapter 2, p. 23). These project design features would minimize disturbance to northern goshawks during the breeding season. Therefore, it is not likely that any direct or indirect effects to goshawks from noise- or smoke-generating activities would occur as a part of this project.

No acres of suitable nesting/roosting or foraging goshawk habitat would be removed through regeneration harvest prescriptions under Alternatives 4 and 5. About 196 acres of suitable nesting/roosting habitat and 113 acres of foraging habitat would be thinned for a total of 309 acres, but would all would remain suitable following the project.

There would be 5.3 miles of temporary roads constructed, with 0.3 mile of these occurring within suitable goshawk habitat (mainly Unit 8). Less than 1 acre of additional habitat would be removed through temporary road construction and landings across the project.

Five new landings occur within suitable habitat (1 in the primary nest zone and 4 in the foraging habitat zone). Approximately 1 acre of suitable habitat would be removed through landing construction activities.

Fuels treatment activities are not expected to impact suitable goshawk habitat. However, there may be some indirect impacts from jackpot burning. Jackpot burning would occur in 975 acres of suitable goshawk habitat. Seventy acres of this habitat occurs within the active territory. Burning would occur outside the breeding season 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. In the long term, reduction of fuel in the stands would improve stand resilience to fire disturbance.

There is one northern goshawk activity center located within the vicinity of the proposed units. Out of 207 acres of suitable habitat within the primary nest zone, 196 acres would be thinned from below, and out of 444 acres of suitable habitat within the foraging habitat zone, 113 acres would be thinned from below. Thinning from below is expected to improve habitat structure. Small openings would be created with the regeneration harvest alternative with green tree legacy outside of the primary nest zone.

All activities would occur between September 1 and February 28, outside the breeding season for this species, within a 200-acre area around active nest trees.

The entire nest grove would be protected. About 9 percent of the suitable habitat within the entire project area would be thinned. Within the one territory, about half of the habitat (47 percent) within the territory would be thinned. No late-mature or old-growth stands would be treated. Only early mature and some mid-mature stands would be thinned from below. Thinning in the understory and creation of small openings in the forest are generally beneficial to improving goshawk habitat (Reynolds et al. 1992). However, thinning may also have short-term negative impacts, so it was considered that any of the action alternatives may impact individual goshawks, but is not likely to lead to a trend toward federal listing because of the additional available habitat throughout the Beaverslide project area.

Cumulative Effects - Goshawk

The cumulative effects analysis area for this species is the Upper Mad River Watershed. Goshawks are yearlong residents and maintain individual territories. Territory size ranges from 0.6 to 15 square miles. The ridges and draws associated with watersheds create natural barriers between territories. Additionally, the Upper Mad River Watershed is a large watershed bordered by South Fork Mountain to the north and Mad River Ridge and Jones Ridge to the south. These ridges are many miles long and often exceed 5,000 feet in elevation. Northern goshawks within the watershed are likely to disperse within the watershed as opposed to crossing the major ridges into other drainages. It is more likely they would disperse into the subwatersheds associated with the Upper Mad River Watershed. There are approximately 30,790 acres of northern goshawk habitat within the Upper Mad River Watershed.

The known past, present and reasonably foreseeable activities within the analysis area include timber harvest, fire, road construction, grazing, and recreation. The activities associated with timber harvest, road construction, wildfire, fire suppression and fuel-treatment activities may be contributing to the cumulative effects to northern goshawk habitat. Logging began in the upper Mad River watersheds in 1963. As of 1998, approximately 16,026 acres had been harvested with 43 percent being treated with clearcuts converting later seral stages to a shrub/ford seral stage (USDA Forest Service 1998).

It is likely that the private lands would continue to experience sporadic selective harvesting and clearcutting, particularly in response to natural disturbances such as the wildfires that occurred in the area in 2008 and the past. It is unknown at this time the level of future timber harvest that would occur on private land; however, in the short term there are presently no timber

harvest plans on file with California Department of Forestry and Fire Protection to perform any harvest of timber on private lands within the Upper Mad River watershed.

Reasonably foreseeable actions include all Forest Service activities in some stage of planning. Kelsey Peak is currently being planned with an analysis area that is adjacent to the Beaverslide project. Similar design features will be utilized. The Little Doe/Low Gulch Timber Sale on the Mad River Ranger District was planned in 2006-2007. The sales in this project are sold, however, no harvesting has occurred (Dan Dill, personal communication 2009). The proposed action for the Little Doe/Low Gulch Project included timber harvesting through non-regeneration methods and activity-generated fuel treatments within designed commercial harvest units, temporary road construction, and road maintenance activities on National Forest System roads along the associated haul route. The Little Doe/Low Gulch Project, once implemented, will thin 156 acres of goshawk habitat. The Little Doe/Low Gulch Project is not in the Beaverslide project area but is within the upper Mad River watershed.

In 2000, approximately 320 acres of suitable goshawk habitat on Federal lands were lost to high-intensity fire associated with the Journey Fire. The adjacent private lands lost about 16 acres of suitable habitat. In 2008, wildfires occurred on the Mad River Ranger District. According to a July 9, 2008 active fire map, no fires were within the Beaverslide project area although one to the southeast was right on the perimeter of the project area.

Road construction (including temporary roads), generally associated with timber harvesting, has occurred on Federal and private lands throughout the watershed. It is not known how much suitable goshawk habitat has been affected by these activities. It is likely that some road building, including skid trails, may continue to occur on private and public land throughout the watershed. The Beaverslide Project proposes to decommission over 8 miles of system roads and unauthorized routes and would also decommission all existing and new temporary roads. Fewer roads could improve habitat in the long term.

There would be no cumulative habitat loss in the existing territory with implementation of the Beaverslide Project since the proposed project would not remove suitable goshawk habitat in the existing territory. Habitat would be thinned, but would be suitable following the project. Thinning from below is known to improve goshawk habitat by promoting the large overstory trees and making small openings (Reynolds et al. 1992). About 1,170 cumulative acres of goshawk habitat would be thinned across the project area with the implementation of the proposed action.

Proposed treatments from the action alternatives may have a short-term negative effect; however, low thinning is a tool for developing the desired habitat conditions when stands are young and dense and have not culminated to goshawk habitat. The action alternatives (direct, indirect, and cumulatively) may impact individuals in the near term, but would not cause a trend toward federal listing (see BA/BE and Wildlife Report).

Pacific Fisher - Affected Environment

Since surveys specific to this area have not occurred, there are no known Pacific fisher (fisher) denning or resting sites within the Beaverslide project area. However, there is suitable denning

and resting habitat within the project area, which includes mid-mature and late-mature habitats with downed trees and other habitat elements such as snags and deformities for resting. In the event that sites are identified during implementation of the project, management activities would be modified to meet the objectives of the Fisher Habitat Capability Model within 500 feet of the site (LRMP FEIS, Appendix B, Table B-18 and LRMP, p. IV-102). Additionally, many critical habitat elements would be retained after harvest following the Forest Plan snag and log retention guidelines, which would be employed as described in Chapter 2, page 23

Fishers occupy low and mid-elevation (between 2,000 and 5,000 feet), multi-storied mature and old-growth mixed-conifer and deciduous-riparian habitats with moderate to dense canopy closure (greater than 50%), in scattered patches with six to eight large snags per acre and abundant down logs (USDA Forest Service 2006). Fishers use cavities in large trees, snags, logs, rock areas, brush piles, and concentrations of downed woody debris for denning and nesting. They forage primarily in dead wood. Therefore, both standing and down log densities are important indicators of habitat quality. Fishers use ridges and streams, covered by closed canopy forests, when moving between quality habitat areas.

Home range for a fisher reproductive unit (one male overlapping two female territories) in northern California averages about 9,800 acres. Fishers appear to be territorial, and are active year-round. Fishers use ridges and streams, covered by closed canopy forests, to move between subwatersheds within their territory. Fishers typically do not stay in one area for extended periods of time, but continue to move, via travel corridors, throughout the territory. Their movements may be attributed to food availability, mate selection, and predator avoidance. They are mostly nocturnal and crepuscular, but are sometimes active during the day.

Survey results in the past decades indicate that the species has most likely been extirpated from the majority of its former range in the western United States. The population in the Klamath region may be the largest remaining in the western states (Zielinski et al. 2000, Powell and Zielinski 1994).

The only fisher surveys conducted on the Mad River Ranger District were from 2004-2006 throughout the Cedar Gap portion of the Upper Mad River Watershed, which is north of Kelsey Peak and 2 miles outside of the project area. These surveys identified 59 rest sites and 1 den site within the study area. Since there were detections during the Cedar Gap surveys, we can expect fisher to occur in the Beaverslide project area. There are no known fisher den sites within the Beaverslide project area from historical records or incidental sighting, but no species-specific surveys for fisher have occurred to date within the Beaverslide project area.

Acres of suitable habitat are based on the vegetative structure (seral and series) at known rest-sites in the watershed. Generally, fisher use similar habitat as the northern spotted owl. There is approximately 3,255 acres of suitable fisher habitat in the project area or about 25 percent of the project area. The proposed units contain approximately 434 acres of suitable fisher habitat, which equates to approximately 13 percent of the fisher habitat in the project area.

Pacific Fisher - Environmental Consequences

Direct and Indirect Effects

Timber harvest and associated management activities may have a minor negative effect to the fisher by removing or damaging suitable habitat components such as mistletoe brooms, witch's broom trees, snags and downed wood. Thinned habitat is expected to remain suitable following the project because the largest and healthiest trees in the stand would be retained and post-harvest canopy closure would be 60 percent or greater. In addition, thinning prescriptions are expected to improve the quality of the habitat and protect it in the long term by accelerating the development of late-successional characteristics and removing the understory ladder fuels to improve stand resilience to fire.

Snags and downed wood provide fisher with denning and resting habitat, as well as escape cover, which allows them to avoid predators and inclement weather. Snag and downed wood requirements would be met in all units at 80 to 100 percent of the average numbers found in mature and old growth forests in the Douglas-fir and white-fir vegetation series (LRMP, p. IV-78 to -79).

There is potential that jackpot burning may impact fisher if suitable denning and resting logs are burned; however burning would only 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. It is expected that these measures would help prevent collateral loss of habitat elements.

In the event that denning or resting sites are identified during implementation of the project, management activities would be modified to meet the objectives of the Fisher Habitat Capability Model within 500 feet of the site (LRMP FEIS, Appendix B, Table B-18 and LRMP, p. IV-102).

Fishers are a highly mobile species, continually moving throughout their home range. Because of their mobile nature, it is expected that fishers would be capable of moving out of an area if management activities were to occur while the animals were present. However, during the breeding season, females are limited in their movements while they are rearing young. Fisher would be most susceptible to disturbance during this time. Young are typically born between February and May and stay with the female until late autumn. Optimal fisher habitat in the proposed units is the same habitat used by the owl and goshawk for nesting and roosting.

There are a total of 3,255 acres of suitable fisher habitat within proposed harvest units. Thinning would occur on 1,170 acres of suitable habitat, but would remain suitable following the project (the largest trees would be retained and canopy closure would be 60 percent or greater) under Alternatives 4 and 5. Jackpot burning would occur on 1,029 acres of suitable fisher habitat under all action alternatives.

A total of 5.3 miles of temporary roads would be constructed under this alternative, with 0.3 mile of temporary roads constructed within fisher habitat. About 1 acre of suitable fisher habitat would be removed with the construction of the temporary roads. Only a very small amount of habitat would be removed for landings.

There may be some disturbance to fisher from noise- and smoke-generating activities; however, these activities would take place when fishers are less susceptible to disturbance (outside the breeding season).

Implementing any action alternative may impact individuals but would not cause a trend towards federal listing. Treatments are designed to maintain and improve fisher habitat.

Cumulative Effects - Pacific Fisher

The cumulative effects analysis area for fisher is the Upper Mad River Watershed. The Upper Mad River Watershed is a large watershed bordered by South Fork Mountain to the north and Mad River Ridge and Jones Ridge to the south. These ridges are many miles long and often exceed 5,000 feet in elevation.

The activities associated with timber harvest, road construction, wildfire, fire suppression and fuel treatment activities may be contributing to the cumulative effects to fisher habitat. For a detailed discussion on cumulative effects to the vegetation see the *"Past Actions and Their Effect on Current Conditions"* in the Vegetation section above.

Past timber harvest activities that have modified suitable fisher habitat on private and public lands within the analysis area, may have contributed to the loss or degradation of suitable fisher habitat. It is estimated that since 1990, approximately 4,180 acres have been harvested on Federal (approximately 1,700 acres) and private lands (approximately 4,480 acres) within the watershed. Past timber harvesting on federal lands removed about 337 acres of suitable fisher habitat. Past timber harvesting on private lands removed about 398 acres of suitable fisher habitat.

It is likely that the private lands would continue to experience sporadic selective harvesting, particularly in response to natural disturbances such as the Journey and Travis wildfires. It is unknown at this time the level of future timber harvest that would occur on private land; however, in the short term there are presently no timber harvest plans on file with the California Department of Forestry and Fire Protection to perform any harvest of timber.

Reasonably foreseeable actions include all Forest Service activities in some stage of planning. As mentioned for the goshawk and the owl, the Little Doe/Low Gulch timber sale has been sold but timber has not been harvested to date. Kelsey Peak is being planned adjacent to the Beaverslide Project. Kelsey Peak will have similar design features to protect sensitive species.

In 2000, suitable fisher habitat was salvage logged on private lands after the Journey Fire. In addition, suitable fisher habitat was lost locally from wildfires and suppression activities including habitat lost on the Shasta-Trinity NF and habitat in the Yolla Bolly area. Fires occurred on the Mad River Ranger District in 2008 and 5 acres of fisher habitat were lost on the Mad River Ranger District from wildfire suppression activities related to the 2008 wildfires.

Road building (including temporary roads) generally associated with timber harvesting, has occurred on Federal and private lands throughout the watershed and is likely to continue. It is not known how much suitable fisher habitat has been affected by these activities. The Beaverslide Project proposes to decommission over 8 miles of system roads and unauthorized routes and

would also decommission all existing and new temporary roads. Fewer roads could improve habitat in the long term.

Proposed treatments from the action alternatives may have a short-term negative effect on fishers; however, the action alternatives (direct, indirect, and cumulatively) may impact individuals but would not cause a trend toward federal listing (see BA/BE, Ray 2009a and 2009b).

Western Pond Turtle - Affected Environment

The western pond turtle is the only freshwater turtle native to the west coast of North America (Stebbins 1985). It is primarily associated with aquatic and riparian habitats from sea level to about 4,500 feet. On the Six Rivers National Forest, the western pond turtle is most commonly seen basking on the banks of main stem rivers. During the spring and summer (the active season) turtles often concentrate in low gradient and low velocity sections of creeks and rivers, especially in sloughs, side channels, and backwater areas. They prefer rivers and creeks that have sunny banks, basking substrates such as exposed logs and root balls, and deep still water with underwater debris for escape cover.

Before the fall rains begin and water levels rise, western pond turtles migrate upslope from the rivers to dig burrows and overwinter on the slopes above the high-water zone. In spring, the turtles migrate back downslope toward the rivers. Female turtles migrate to alluvial nesting benches to lay eggs. Western pond turtles exhibit nest site fidelity, which means once they reach sexual maturity, females return to the nesting bench they hatched from to lay their eggs. Nesting benches are usually located on flat benches on the banks of rivers in close proximity to rearing habitat (shallow water and riparian vegetation). Once the turtles arrive at the nesting benches they dig holes in the loose friable soil, lay their eggs in the holes and cover them up with the displaced soil. This friable soil is limiting in the location of operations below the county road where mastication would occur due to the density of cobble and native rock associated with this area.

When the juvenile turtles hatch, they are about the size of a quarter and are very susceptible to predation. Many migrate to the nearest rearing habitat. Rearing habitat consists of shallow edgewater areas with minimal current and lush vegetation including ponds, springs and vernal pools. Lush vegetation provides cover, shade, basking opportunities, and forage. The juvenile turtles may remain in the rearing habitat for several years until they are larger, stronger and less susceptible to predation. Once able, the turtles leave the rearing habitat and migrate to the main stem rivers.

Western pond turtle hatchlings and juveniles have relatively specialized habitat requirements that are particularly susceptible to disturbance. The important habitat components of nesting and rearing habitat include flat benches, loose soil, shallow water and lush aquatic and riparian vegetation.

The Forest manages riparian reserves that provide this species with large blocks of contiguous habitat. There are approximately 5,933 acres of riparian reserves within the Upper Mad River Watershed. Western pond turtles are known to occur within the Upper Mad River

boundary, which provides the primary habitat for this species within the watershed. The project area contains approximately 566 acres of western pond turtle habitat within 492 feet (150 meters) of the Mad River. There is an existing developed water source on the Mad River off of NFS Road 27N13 at a concrete low-water bridge. Western pond turtles have been observed at this location on several occasions. Mastication of manzanita and some thinning would occur upslope of habitat for this species.

Western Pond Turtle – Environmental Consequences

Direct and Indirect Effects

All riparian reserves within the project area were identified and the full interim riparian reserve buffer widths were established. It is anticipated that there would be little to no impacts to riparian habitat in the project area, as the intermittent stream channels have no harvest activities, fuels treatment, temporary road or landing construction occurring within one tree-height of riparian reserve widths. The main stem Mad River was buffered with a two site-potential tree-height distance adding further insurance that impacts would be minimized. No activities would occur within the inner buffer (two site-potential-tree-height distance); however, a small amount of mastication and timber thinning would occur in the outer buffer of the riparian reserve.

One activity occurring within suitable western pond turtle habitat is water drafting. “Water-drafting” is a short-duration, small-pump operation that withdraws water from identified streams or impoundments to fill conventional tank trucks or trailers. Usually, this water is used to control road dust. Water drafting at the 27N13 low water crossing bridge on the Mad River has the potential to cause direct harm or injury to turtles if they are sucked up in the intake hose while water drafting is occurring. However, these impacts would be negligible since the project design features require the intake hose to be screened so it cannot suck up salmonid fishes and therefore cannot draft even the smallest juvenile turtle (see Chapter 2, page 22). These project design features would minimize the potential for direct injury or death to western pond turtles from water drafting.

Mastication of manzanita would occur upslope of primary habitat for this species. Mastication would only occur within less than 1 acre of the outer buffer of the riparian reserve where western pond turtle are known to exist. No mastication or treatment of any kind would occur within the primary habitat, which is within the inner half of riparian reserve buffer. There are limited benches within the two site-potential-tree-height distance from the edge of the Mad River (inner buffer). A small amount of mastication would occur near or within the habitat where the benches occur. Although the mastication treatments would be extremely limited, there is a possibility some individuals would be impacted.

Cumulative Effects

There are approximately 3,875 acres of suitable western pond turtle habitat within the Upper Mad River Watershed. The project design features described above and in Chapter 2 would minimize the potential for direct injury or death to western pond turtles from water drafting. There would

be no substantial direct or indirect effects to the western pond turtle from these activities. Therefore, there would be no measurable cumulative effects associated with this activity.

Because of the limited amount of possible disturbance from water drafting and fuel treatment within Manzanita, the action alternatives (direct, indirect, and cumulatively) may impact individuals but would not cause a trend toward federal listing (see BA/BE and Wildlife Report).

Northern Red-legged Frog and Foothill Yellow-legged Frog - Affected Environment

Northern red-legged frogs are associated with moist forests and riparian areas usually below 2,876 feet (850 m) in elevation. Red-legged frogs require cold water and dense riparian vegetation and are generally found near permanent bodies of quiet water with submerged vegetation for egg attachment including small ponds, pools along streams, springs, lakes, and marshes.

Northern red-legged frogs are present in the Beaverslide project area but no data exists past incidental sightings in the Mad River area (Dan Dill, personal communication, 2/13/09). There are no records of this species in the Forest Wildlife Sighting Database. This species utilizes perennial small ponds, pools, springs, lakes, and marsh habitats that contain cold water and emergent vegetation (USDA Forest Service 2006a). Activities such as water drafting and mastication for fuel reduction would occur adjacent to these habitats along roads, which typically lack the microsite conditions such as cold water and shade that are critical elements of suitable red-legged frog habitat.

The foothill yellow-legged frog is most commonly associated with streams and main stem rivers that have a rocky (gravel/cobble) substrate. This species has also been seen in other riparian habitats including moderately vegetated backwaters, isolated pools, and slow-moving rivers with mud substrates. Components of suitable foothill yellow-legged frog habitat include clean water, gravel and cobble substrates and lush riparian vegetation. Good water quality is an important habitat component because these frogs spend a majority of their life cycle in water and absorb contaminants through their skin. Gravel and cobble substrates and lush aquatic and riparian vegetation provide cover and shade. When frightened, this species dives to the bottom and takes refuge among the camouflaging stones and vegetation.

Foothill yellow-legged frogs are known to occur within the Upper Mad River, which provides the primary habitat for this species within the project area. Stream surveys have documented this species in large numbers at various stages of metamorphosis. The project area contains approximately 566 acres of foothill yellow-legged frog habitat. These acres are calculated by placing a 150-meter buffer along the Upper Mad River within the project area. With the exception of water drafting, no actions would occur within the riparian reserves in the project area.

Northern Red-legged Frog and Foothill Yellow-legged Frog – Environmental Consequences

Direct and Indirect Effects

Northern red-legged and foothill yellow-legged frogs are known to occur within the Upper Mad River, which provides the primary habitat for this species within the project area. The project area contains approximately 566 acres of foothill yellow-legged frog habitat within and adjacent to the Upper Mad River. There is an existing developed water source on the Mad River off FS Road 27N13 at a concrete low water bridge. Foothill yellow-legged frogs have been observed at this location.

Commercial thinning of plantations and of stands containing early through mid-mature seral stages would occur on 532 acres within the outer one-half of the width of riparian reserves. This area is greater than 160 feet from the edge of the channel on perennial non-fish bearing, intermittent, and ephemeral with scour streams, and a slope distance of 320 feet on fish-bearing streams. This is across the project area. A total of 690 acres of fuel treatment corridors would occur in riparian reserves. A total of 309 acres of fuel treatment corridors would occur within the outer half of the riparian reserve stream buffer.

All riparian reserves within the project area were identified and the full interim riparian reserve buffer widths were established. It is anticipated that there would be little to no impacts to the riparian processes in the project area, as the intermittent stream channels have no harvest activities, fuels treatment, temporary road or landing construction occurring within the one tree height riparian reserve widths. The main stem Mad River was buffered with a two site-potential tree height distance adding further insurance impacts would be minimized.

The only activity occurring within suitable foothill yellow-legged frog habitat is water drafting (see discussion about water drafting on page 70). Water drafting at the 27N13 low water crossing bridge on the Mad River has the potential to cause direct harm or injury to foothill yellow-legged frogs if they are sucked up in the intake hose while water drafting is occurring. However, these impacts would be negligible since the project design features associated with this project require the intake hose to be screened to prevent salmonid fish uptake (see Chapter 2, page 22). All of the frogs observed at this location have been adult frogs at least 3 inches in size or greater, insuring that the screening would effectively block frogs from being pulled into the hose. These project design features would minimize the potential for direct injury or death to foothill yellow-legged frogs from water drafting.

There would be no substantial direct or indirect effects to the foothill yellow-legged frog from water drafting because intake hoses would be screened, and there would be no significant change in flow conditions as there is continual recharge where water is being drafted.

Cumulative Effects

There are approximately 3,875 acres of suitable foothill yellow-legged frog habitat within the Upper Mad River Watershed. The project design features described above and in Chapter 2 would minimize the potential for direct injury or death to foothill yellow-legged frogs from water

drafting. There would be no substantial direct or indirect effects to the foothill yellow-legged frog from these activities. Therefore, there would be no measurable cumulative effects associated with this activity.

Because of the protection of the riparian reserves and the only possible disturbance from any of the action alternatives would be from water drafting, the action alternatives (direct, indirect, and cumulatively) may impact individuals but would not cause a trend toward federal listing (see BA/BE, Ray 2009a and 2009b).

Management Indicator Species (MIS)

The management indicator species (MIS) for the Six Rivers National Forest were selected in order to meet the wildlife resource management goal in the LRMP to "[m]aintain viable populations of all native and desirable non-native wildlife species occurring on the Forest by providing the variety, distribution, and amount of wildlife habitat types necessary, and maintaining a biologically diverse and functional forest landscape ecosystem." The Forest has focused on this goal through the monitoring and protection of the selected MIS whose population status and trends are assumed to reflect: (1) the overall health and integrity of their respective biotic assemblage or community as a whole, and (2) community-level responses to management related disturbances (LRMP p. IV-99). Of the 41 MIS listed for the Forest, 27 occur or have habitat within the project area. These MIS are intended to identify potential beneficial or adverse effects on specific species or habitats of concern, establish the significance of those effects, and to eliminate or minimize any adverse effects. Listed in Table 27 are the MIS for the Forest.

Table 27. All management indicator species - Six Rivers NF

MIS assemblages	MIS Species
Individual species (5 species)	Northern spotted owl, black bear, American marten, fisher, black tailed deer
Marsh/lake/pond assemblage (5 species)	Northern red-legged frog, arboreal salamander, western pond turtle, clouded salamander, wood duck
Tanoak/Madrone assemblage (3 species)	Hammond's flycatcher, western tanager, black-headed grosbeak
Snag assemblage (10 species)	Flammulated owl, western screech owl, red-bellied sapsucker, downy woodpecker, hairy woodpecker, white-headed woodpecker, Vaux's swift, brown creeper, western bluebird, Douglas squirrel
Downed woody material assemblage (3 species)	Blue grouse, dusky-footed woodrat, western fence lizard
Bog/seep/spring/wet assemblage (1 species)	Southern torrent salamander
River/stream/creek assemblage (4 species)	Cutthroat trout, steelhead/rainbow trout, summer steelhead
Black oak/white oak assemblage (10 species)	Acorn woodpecker, tailed frog, scrub jay, common merganser, Lazuli bunting, ruffed grouse, western gray squirrel, winter wren, American dipper, yellow-breasted chat

Management indicator species are selected on the basis of their known roles in their respective biotic assemblage or community. Many MIS occupy a niche in their particular

assemblage that is either highly dependent on other members, or may be extremely sensitive to management related disturbance, or both. Other MIS were selected based on concern for their current population status. It is assumed that, with current knowledge, these MIS are indicative of the integrity of communities as a whole, where they serve to focus the Forest's monitoring and feedback loop, and provide an assessment of the overall health of the represented habitats/ecosystems. These species serve as the primary measure of the biological diversity trend on the Forest.

Table 28 lists the species that have habitat in or adjacent to the project area that will be addressed. Species eliminated from analysis are also shown. Survey data was collected for northern spotted owl and northern goshawk in 2008 for this project and additional surveys will occur in 2009. Survey data for MIS species is available from breeding bird survey routes, bird point-count surveys conducted in association with the Marbled Murrelet Range & Distribution (R&D) Study, mollusk surveys, SRNF Forest Carnivore Study (1993-1997), bat surveys utilizing mist-netting techniques (2003-2004) and extensive forest carnivore track plate and infrared camera surveys that have occurred throughout the Mad River Ranger District. Additionally anecdotal information from incidental sightings by other Forest Service personnel and members of the public is reviewed.

Table 28. Management indicator species analyzed for the Beaverslide Project

MIS species and habitat assemblages	Suitable habitat occurs within the project area and may be directly and indirectly affected by project activities	Habitat is in or adjacent to the project areas, but is not directly or indirectly affected by the project	Habitat is not in or adjacent to the project area and is not directly affected by the project
Individual Species			
Northern spotted owl	X		
Pileated woodpecker	X		
Black bear	X		
American marten	X		
Fisher	X		
Black-tailed deer	X		
Bog/Seep/Spring/Wet Meadow Assemblage			
Southern torrent salamander		X	
Marsh/ Lake/ Pond/ Assemblage			
Northern red-legged frog	X		
Western pond turtle	X		
Wood duck			X
River/Stream/Creek Assemblage			
Cutthroat trout			X
Rainbow trout	X		
Steelhead / Summer Steelhead			X
Tailed frog		X	
Common merganser		X	
Ruffed grouse		X	

MIS species and habitat assemblages	Suitable habitat occurs within the project area and may be directly and indirectly affected by project activities	Habitat is in or adjacent to the project areas, but is not directly or indirectly affected by the project	Habitat is not in or adjacent to the project area and is not directly affected by the project
Winter wren		X	
American dipper		X	
Yellow-breasted chat		X	
Tanoak/Madrone Assemblage			
Hammond's flycatcher	X		
Western tanager	X		
Black-headed grosbeak	X		
Snag Assemblage			
Flammulated owl	X		
Western screech owl	X		
Red-breasted sapsucker	X		
Downy woodpecker	X		
Hairy woodpecker	X		
White-headed woodpecker	X		
Vaux's swift	X		
Brown creeper	X		
Western bluebird	X		
Douglas squirrel	X		
Down Woody Debris Assemblage			
Arboreal salamander		X	
Clouded salamander		X	
Blue grouse	X		
Dusky-footed wood rat	X		
Western fence lizard	X		
Black Oak/White Oak Assemblage			
Acorn woodpecker	X		
Scrub jay	X		
Lazuli bunting	X		
Western gray squirrel	X		

Northern Spotted Owl

The northern spotted owl (*Strix occidentalis*) is federally listed as “threatened” and is a species of high public interest that can be practically monitored. Changes in northern spotted owl populations can indicate effects of management on other species requiring mature and old-growth forests. These habitats contain the structure and characteristics required for nesting, roosting, and foraging. Northern spotted owls are discussed in detail above on page 48, and in the Wildlife Biological Assessment/Evaluation (Ray 2009a) and Degradation Analysis (Ray 2009c).

Pileated Woodpecker

Suitable and optimal pileated woodpecker habitat is similar to conditions preferred by the Northern spotted owl and the Pacific fisher. Pileated woodpeckers prefer multi-storied mature and late-mature successional-conifer forests with moderate to dense canopy closure (60 percent), and

abundant snags and down logs. This species forages primarily in dead wood; therefore, both standing snag and down log densities are important indicators of habitat quality (Bull and Holthausen 1993). Carpenter ants, wood boring beetles and larvae (Zeiner et al. 1990) are the primary prey of pileated woodpeckers. The species is a primary cavity nester utilizing dead or dying trees. There are no known nesting or roosting sites within the project area. No project-specific surveys for this species have occurred in the project area, but there have been several detections of the species in the area. The species has also been seen and heard on the South Fork Mountain Breeding Bird Survey Route (CAL – 953) and was recorded an average of 1.33 times per survey since route initiation in 1994. The Six Rivers NF Wildlife Sighting Record Database contains approximately 55 sighting records for the Mad River Ranger District.

Pacific Fisher

The Pacific fisher (*Martes pennanti*) is a relative of the mink, otter, and marten and is a predator dependent upon mature and old growth forests. Fishers use large areas of primarily coniferous forests with fairly dense canopies and large trees, snags, and down logs. The fisher prefers forests with high canopy cover and mature and old-growth stands, and requires large trees for denning. The fisher dens in rotting logs, hollow trees, and rocky crevices of old growth forests. This species is also on the Forest sensitive species list. Pacific fisher is discussed in detail on page 65 in the section on threatened and endangered species (also see Ray 2009a).

Black Bear

The black bear (*Ursus americanus*) is a harvest species that is one of four species of greatest concern to the public, State, or Forest Service (LRMP p. IV-99). Black bears are a generalist species that are distributed throughout much of North America. In California, they are common with a population estimate of about 30,000. They can be found mostly in mountainous areas above 3,000 feet elevation. The California Department of Fish and Game (DFG) monitor black bear populations within northwestern California. Black bear is “S5- secure” (“demonstrably widespread, abundant, and secure”) in California (CA Natural Diversity Database). California's black bear population has increased over the past 25 years. Sitton (1982) estimated the statewide bear population to be between 10,000 and 15,000 animals. Presently, the statewide black bear population within the 52,000 square miles of known range is conservatively estimated to be between 25,000 and 30,000 (CA Department of Fish and Game[3]). Previous and ongoing studies indicate that bear densities range from 1.0 to 2.5 bears per square mile in the North Coast/Cascade (50 percent of the statewide population). The northern portion of California is continually noted by CA DFG as supporting the highest density of bears of any area within the western United States.

Black bear are known to occur within the project area. There is approximately 30,000 acres of mid- and late-successional habitat within the Upper Mad River Watershed. There are no known bear dens or wallows within the project area or proposed units. If a bear den or wallow is detected

[3] http://dfg.ca.gov/wildlife/hunting/bear/index.html

during the implementation of the project, the following standard and guideline from the LRMP would be followed:

> **8-38** - Bear wallows and dens will be protected by maintaining essential habitat characteristics within 200 feet of the den or wallow. Maintain vegetation near the den or wallow that provides a visual screen from roads, trails, and other areas frequented by people.

American Marten

Marten prefer multi-storied mature and old-growth mixed conifer, white fir (*Abies concolor*), red fir (*Abies magnifica*), and pine (*Pinus* spp.) forests, with moderate to dense canopy closure (greater than 40 percent). They require nearby small meadows, clearings, or riparian areas for foraging habitat. Closed canopy travelways (especially on ridgetops) are also necessary between foraging areas. Denning and resting habitats consist of cavities in large trees, snags, stumps, logs, caves, rocky crevices, and sometimes woodpiles. Moderate and high-quality habitats contain two to three large snags and 10 to 20 large logs per acre.

Surveys conducted from 1993 to 1997, as part of the SRNF Forest Carnivore Study (http://maps.fs.fed.us/carnivore/Map.jsp), did not detect marten on the Mad River Ranger District. No species-specific surveys have been conducted for marten within the Beaverslide project area. There is one historic unconfirmed incidental observation of marten in the Forest Wildlife Sighting Database. Fisher and marten have similar physical characteristics and can easily be confused by the untrained observer. Based on the known presence of fisher and lack of detections of marten on the District, it is likely that this observation was a misidentified fisher.

American marten are not known to occur in the project area or on the entire Mad River Ranger District. However, the project area is within the range of the Humboldt marten subspecies of the American marten (Zelinski et al. 2000).

Black-Tailed Deer

Black tailed deer (*odocoileus hemionus*) is a harvest species that is one of four species of greatest concern to the public, State, or Forest Service (LRMP p. IV-99). The black-tailed deer is a common widespread game species that occurs throughout most of California. This species is a habitat generalist and is known to occur in a variety of habitats including conifer, oak woodland, shrub, riparian and meadow habitats. This species typically moves through elevation gradients between these various habitat types in response to seasonal changes in temperature, available cover, forage and water. Black-tailed deer is common in the project area.

Marsh/Lake/Pond Assemblage

Western Pond Turtle

This species is also listed as a sensitive species for the Mad River Ranger District. It is discussed in detail under the Sensitive Species section on page 69, and in the BA/E.

Tanoak/Madrone Assemblage

Hammond's Flycatcher

A small and unassuming flycatcher of western North America, Hammond's Flycatcher breeds in mature coniferous forests. This species breeds from central Alaska southward through western Canada to California and western Colorado. It is a migratory bird that over winters in Mexico and Central America. Populations appear stable or increasing. The species' preference for mature forests suggests that logging of old-growth forests may pose an eventual threat. This species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 6.0 per route per annum (range 6-12/survey). This species was also detected during bird point-count surveys conducted in association with the Marbled Murrelet Range & Distribution (R&D) Study on the District.

Western Tanager

Despite its striking markings of red, yellow, and black, the slow-moving western tanager is a surprisingly inconspicuous bird of the western forests. It breeds from southern Northwest Territories and southeastern Alaska southward through western states, and eastward to western Manitoba, Black Hills of South Dakota, and western Texas. These migratory birds overwinter from central Mexico through Costa Rica with some individuals wintering in southern California. It breeds in open coniferous and mixed-deciduous-coniferous forests. Western tanager is known to occur within the project area. This species has also been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 28.67 per route per annum (range 25-37/survey). Bird point-count surveys conducted in association with the Marbled Murrelet R&D detected western tanager within the project area.

Black-headed Grosbeak

This medium-sized, stocky songbird is a common and familiar bird of the American west. It can be found in mountain forests, along desert streams, or in backyards and gardens. The Black-headed grosbeak (*Pheucticus melanocephalus*) breeds from southern British Columbia eastward to western North Dakota, central Kansas, and western Texas southward to southern Mexico. It is a migratory bird that winters in southern Mexico. This is a common species with populations generally slightly increasing. Black-headed grosbeak is known to occur within the project area. This species has also been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 5.0 per route per annum (range 3-9/survey). Bird point-count surveys conducted in association with the Marbled Murrelet R&D detected black-headed grosbeak within the project area.

Snag Assemblage

Flammulated Owl

This is North America's smallest eared owl and it is the only small owl with dark blackish-brown eyes (all other small owls have a yellow iris), making it very distinctive. The flammulated owl (*Otus flammeolus*) is usually exclusively an insectivore and is generally associated with montane

forested habitats often with brushy understory. This species also seems to be somewhat colonial, congregating in breeding populations limited to one area with adjacent areas of optimum habitat having no birds present. This species is an uncommon summer resident locally on the District; however, during the 2008 northern spotted owl surveys, many individuals were detected across the project area. The average home range for two males in the Sierra Nevada is 100 acres. Breeding densities have varied from 3.2 to 5.2 males per 247 acres (Marshall 1939, Winter 1974).

Western Screech-owl

The Western screech-owl (*Megascops kennicottii*) uses a wide variety of habitats in their western range of North America. They can be found from the northern temperate rainforests to the southern Sonoran deserts. In general, their habitat should provide adequate roosting sites with open areas for foraging and an abundance of small mammals and insects. Open woods, especially oak, mixed pine/oak or sycamore are favorites. They also occur in semi-open country with scattered bushes and trees, stands of cottonwoods, saguaro cacti in upland deserts, deciduous river bottoms, and groves of mesquite. Their bark-like plumage and variations in color make them almost invisible in a variety of habitats. The Western screech-owl is strictly nocturnal. The Western screech-owl is not very well sampled by the Breeding Bird Surveys because they are very unlikely to be detected except by vocalizations and they are not very vocal immediately prior to sunrise when these surveys commence. Hence, there is very little data available for the entire screech-owl complex (USGS North American Breeding Bird Survey). However, this species was detected during the 2008 northern spotted owl and northern goshawk surveys in the project area. The average home range identified by Craighead and Craighead (1956) reported 0.4 to 0.5 per square mile in winter and 0.7 to 1.9 per square mile in summer. Mean territory size in woodlands in Kansas was 0.7 acre (Fitch 1947). The Six Rivers NF Wildlife Sighting Record Database contains approximately 28 sighting records for the Mad River Ranger District.

Red-breasted Sapsucker

The red-breasted sapsucker (*Sphyrapicus ruber*) is a denizen of the coniferous forests of the northern Pacific Coast, usually found at middle or lower elevations. This species breeds primarily in coniferous forests, but also uses deciduous and riparian habitat, as well as orchards and power line cuts. It winters in a variety of forested habitats. The average territory size, as identified by Howell (1952) in Modoc County, California, ranges from a minimum of 150 feet around the nest up to 15 acres. The Six Rivers NF Wildlife Sighting Record Database contains approximately 4 sighting records for the Mad River Ranger District. The species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 5.00 per route per annum (range 2-10). In addition, bird point-count surveys conducted in association with the Marbled Murrelet R&D detected red-breasted sapsuckers.

Downy Woodpecker

The Downy woodpecker (*Picoides pubescens*) is found in most of the plant communities in California excepting the desert and semi desert areas east of the Sierra Nevada range and south of

the peninsular range. This woodpecker's favored habitat is deciduous riparian woodlands. It does not migrate, but it may move upslope in the Sierra during the summer. This species gleans ants and beetles from the bark of tees and often forages in shrubs for nuts and berries. It is considered widespread and abundant and might be slightly increasing in some areas. The average territory size reported by Lawrence (1967) in Ontario reported breeding territories of 2.0 and 3.2 hectares (5 and 9 acres). The Six Rivers NF Wildlife Sighting Record Database contains one sighting record for the Mad River Ranger District. The species has not been recorded from Breeding Bird Survey Routes since 1994.

Hairy Woodpecker

The Hairy woodpecker (*Picoides villosus*) is a small monogamous woodpecker that resides from Alaska across Canada south throughout the U.S. to the Gulf of Mexico. Some northern birds migrate south for the winter. The hairy woodpecker is associated with the varied structure of mature and old-growth forests. It is considered to be common and widespread. The Six Rivers NF Wildlife Sighting Record Database contains six sighting record for the Mad River Ranger District. The species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 903) with an average detection of 4.33 per route per annum (range 1-9 per survey). In addition, bird point-count surveys conducted in association with the Marbled Murrelet R&D detected hairy woodpecker.

White-headed Woodpecker

The white-headed woodpecker (*Picoides albolarvatus*) is dependent on pine or mixed-pine-fir forests throughout its range in western North America (Garrett et al 1996). This woodpecker uses snags for nesting and large trees for foraging. In 1996, this species was found to be definitely increasing over recent decades at a rate of over 3.4 percent per year. This is partly attributed to a direct result of human activities in the form of adaptive responses on the part of the birds from selective harvest practices, particularly timber thinning such as proposed in much of this project. The Six Rivers NF Wildlife Sighting Record Database contains seven sighting records for the Mad River Ranger District. The species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 7.33 per route per annum (range 4-10/survey). This species was not detected during the bird point-count surveys conducted in association with the Marbled Murrelet R&D.

Vaux’s Swift

Vaux’s Swift (*Chaetura vauxi*) are summer breeding residents of northern California. They breed fairly often in the Coast Ranges from Sonoma County in the north and very locally south to Santa Cruz County. The species prefers redwood and Douglas-fir habitats with nest sites in hollow trees and snags. They are fairly common migrants throughout most of the state in April and May, and August and September. Vaux’s swifts occur in spring and summer, although not necessarily as breeders, on the Six Rivers National Forest. A wide variety of tree sizes and cover classes are used for reproduction, feeding, and cover. Because forest edges, meadows, burned areas and

special features like streams, rivers, ponds, and lakes are used for foraging, habitat fragmentation would appear to have little effect on these swifts. The average home range reported by Bull and Beckwith (1993) is identified a maximum of 3.4 miles from nests; however, during the majority of the study radio-tagged swifts were recorded within 247 acres of the nest. The Six Rivers NF Wildlife Sighting Record Database contains one sighting record for the Mad River Ranger District. The species has not been recorded in association with the Pilot Creek Breeding Bird Survey Route (CAL – 903) (Mad River Ranger District) since route initiation in 1994.

Brown Creeper

The brown creeper is a common to uncommon resident in montane habitats throughout the state of California, and in coastal conifer habitats south to San Luis Obispo County. This species is a rare transient in southern deserts on Channel Islands in fall and winter. Brown creeper prefers habitats containing dense, mature stands of conifers, but is also found in hardwood and hardwood –conifer habitats, especially in winter. Hardwoods and riparian deciduous trees are also used as a source of cover primarily during winter. Nests are typically constructed behind loose bark and rarely within cavities and are found usually within old-growth incense cedar, coastal redwood, pine, fir, or snags. The average home range for the brown creeper identified by Bock and Lynch (1970) within the Sierra Nevada was 27 acres. The Six Rivers NF Wildlife Sighting Record Database contains 5 sighting records for the Mad River Ranger District. The species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 5.33 per route per annum (range 2-17/survey). In addition, bird point-count surveys conducted in association with the Marbled Murrelet R&D detected the brown creeper within the project area.

Western Bluebird

The Western Bluebird (*Sialia Mexicana*) is a common sight in parklands of the West. Unlike the other species of bluebirds, it does not like large meadows, preferring open forests instead. Summer range for this species is Western North America from southern British Columbia south to central Mexico, east to western Montana and west Texas, but absent from Great Basin. It winters at lower elevations in much of breeding range and also winters outside breeding range in central California and along the lower Colorado River. Habitat is open coniferous and deciduous woodlands, wooded riparian areas, grasslands, farmlands, and edge and burned areas. The Six Rivers NF Wildlife Sighting Record Database includes four sighting records for the Mad River Ranger District. The species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 953) with an average detection rate of 3.0 per route per annum (range 1-6/survey). No western bluebirds were detected during the bird point-count surveys conducted in association with the Marbled Murrelet R&D.

Douglas Squirrel

Habitat for this species is primarily coniferous forests. Its range is Southwestern British Columbia, Western Washington, Western and Central Oregon, and Northern California. The

Douglas squirrel is very active throughout the year. It eats new shoots of conifers, green vegetation, acorns, nuts, mushrooms, fruits, and berries. In late summer and fall, this squirrel cuts cones from tree limbs and feeds on the seeds at special feeding stations in trees, below which discarded scales pile into middens. Although the Six Rivers NF Wildlife Sighting Record Database contains only 1 sighting record of this species on the Mad River Ranger District, this species is considered common and abundant. Bird point-count surveys conducted in association with the Marbled Murrelet R&D detected Douglas squirrel at nine stations.

Downed Woody Material Assemblage

Blue Grouse

The blue grouse is a medium-sized, stocky, round-winged, chicken-like bird that is about 17 inches in length. It has a long, squared tail. Blue grouse are endemic to mountainous regions of western North America and have a restricted geographic range. Nevertheless, this species occupies a wide range of breeding habitats from maritime to continental in climate, from sea level to 11,800 feet in elevation, and from northwestern coast rain forest to shrub/steppe high desert and subalpine/alpine tundra. Virtually all populations winter in conifer forest, where conifer needles comprise the main winter food. Their distribution appears to be partly determined by the proximity of suitable breeding areas to montane forest acceptable for use in winter. As a species, Blue grouse share physical and behavioral attributes with both ‘forest’ and ‘prairie’ grouse in the subfamily Tetraoninae. Occupation of relatively inaccessible montane forests during much of the year contributes to a generally healthy status in many areas. This species is known to occur within the project area. The species has been recorded in association with the South Fork Mountain Breeding Bird Survey Route (CAL – 95) (Mad River Ranger District) and detections were recorded since route initiation in 1994. Specifically, the average detection rate associated with the Pilot Creek BBS Route is 1.33 per route per annum. This species was also detected during mollusk surveys in the project area.

Dusky-footed Woodrat

Woodrats have a rat-like appearance, with long tails, large ears and large black eyes. They are distinctly larger than deer mice, harvest mice and grasshopper mice, and usually slightly larger than the cotton rats. The three species of woodrats found in California and Baja California can be distinguished from each other by size and coloration. Woodrats are found throughout California and Baja California. The Dusky-footed Woodrat is found statewide in California (except in the desert regions and High Sierra) and in the northwestern region of the Baja California peninsula. In regions where there appears to be an overlap of range for the three species of woodrats, each is found usually in different habitats. Extensive forest carnivore track plate and infrared camera surveys have occurred throughout the Mad River Ranger District and the dusky-footed woodrat was detected on several occasions.

Western Fence Lizard

The western fence lizard is probably California's most common reptile. This adaptable lizard is found throughout California except in true desert, where it is restricted to riparian and high mountain locations. The species ranges in elevation from sea level to 10,000 feet. Western fence lizards utilize a variety of habitats from valley-hardwood, grasslands, coniferous, hardwood, and alpine communities. Cover includes tree trunks, woodpiles, wooden fences, rock piles, crevices, burrows, and accumulations of coarse woody debris. Eggs are usually laid within damp, friable, well-aerated soil, in pits dug by females. This species is seen often across the district.

Black Oak/White Oak Assemblage

Acorn Woodpecker

The acorn woodpecker (*Melanerpes formicivorus*) is a common bird of western oak forests that lives in extended family groups where all members of the group spend hours storing thousands of acorns in carefully tended holes in a single tree called a granary tree. One granary tree can have up to 50,000 holes in it, each holding a single acorn. In parts of its range the acorn woodpecker does not construct a granary tree, but instead stores acorns in natural holes and cracks in bark. This species is a resident in western Oregon, California, Arizona, New Mexico and western Texas, southward through Mexico and Central America. Preferred habitat is oak and pine-oak woodlands, generally in mountains and it is common in urban parks and suburban areas where oaks are common. Acorn woodpecker is common with stable populations. The average territory size for the acorn woodpecker as reported by MacRoberts and MacRoberts (1976) varied in size from 8.7 to 22.2 acres in size. Swearingen (1977) reported average territory size in the coast range of California to be approximately 6 acres. The acorn woodpecker is known to occur in suitable habitat within the project area. This species has been detected in association with the South Fork Mountain Breeding Bird Survey Route (CA-953) (Mad River Ranger District).

Western Scrub-jay

The western scrub-jay (*Aphelocoma californica*) is common throughout much of the western lowlands, especially in areas with oaks and pinyon pines. It has adapted well to suburbs and comes readily to bird feeders. The species formerly known as "Scrub Jay" has been broken into three separate species: The Florida scrub-jay, the island scrub-jay, and the western scrub-jay. The western scrub-jay can be divided into three forms, each of which may or may not be a separate species. It is a resident from southern Washington, Idaho, and Wyoming, southward into southern Mexico, and eastward to central Texas. Preferred habitat is oak and juniper scrub, chaparral, oak and pine woodland, riparian woodland, gardens, and orchards. Scrub-jay is common and populations may be increasing. The isolated subspecies found only in the Eagle Mountains of southeastern California is potentially vulnerable to disturbance, and is listed as a species of special concern in California. The average territory size as reported by Verbeek (1973) for the western scrub jay is approximately 7.5 acres in California.

The species has been recorded in association with the Pilot Creek Breeding Bird Survey Route (CAL – 903) (Mad River Ranger District) and detections were recorded since route

initiation in 1994. Specifically, the average detection rate associated with the Pilot Creek Breeding Bird Survey Route is 0.33 per route per annum. The Six Rivers NF Wildlife Sighting Record Database contains three sighting records for the Mad River Ranger District. The western scrub jay is known to occur within the project area and is considered common.

Lazuli Bunting

The lazuli bunting is a common songbird associated with scrub and oak woodland habitats throughout California. Components of suitable lazuli bunting habitat include the presence of oaks, shrubs and herbaceous vegetation, abundant forage and available water. This species prefers shrub/oak woodland habitats with dense undergrowth that provides shade, cover, nesting habitat and abundant forage and prey. The lazuli bunting constructs its nest in dense thickets of shrubs, vines, low trees and tall forbs, usually near water. This species typically eats insects and small seeds. The reported breeding density as reported by Archie and Hudson (1973) identified four males per 100 acres in Grant County, Oregon. Gaines (1974) identified 16 males per 100 acres of riparian habitats within California. This species has been recorded in association with the Pilot Creek Breeding Bird Survey Route (CAL – 903) (Mad River Ranger District) and detections were recorded since route initiation in 1994. Specifically, the average detection rate associated with the Pilot Creek BBS Route is 8.0 per route per annum. The Six Rivers NF Wildlife Sighting Record Database contains five sighting records for the Mad River Ranger District. The lazuli bunting is known to occur within the project area and is considered a fairly common summer visitor and breeder.

Western Gray Squirrel

The western gray squirrel (*Sciurus griseus*) is an arboreal rodent found along the western coast of the United States and Canada. Compared with the eastern gray squirrel *S. carolinensis* or the eastern fox squirrel (which have been introduced into its range), these squirrels are shy, and will generally run up a tree and give a hoarse barking call when disturbed. It is the largest native tree squirrel in the western coastal United States. Western gray squirrels are forest dwellers, and can be found at elevations up to at 2,000 meters or more. Time on the ground is spent foraging, but they prefer to travel distances from tree to tree. They are strictly diurnal, and feed mainly on seeds and nuts, particularly pine seeds and acorns, though they will also take berries, fungus and other food. Pine nuts and acorns are considered critical foods because they are very high in oil and moderately high in carbohydrates, which help increase the development of body fat.

Populations of the western gray squirrel have not recovered from past reductions. They are threatened with habitat loss, road-kill mortality, and disease. Habitat has been lost due to urbanization, catastrophic wild fires, and areas of forest degraded by fire suppression and overgrazing which allowed the invasion of Scot's Broom. Notoedric mange, a disease caused by mites, has become epidemic in western gray squirrel populations and is a major source of mortality. This species is considered common throughout the Six Rivers National Forest. The project area contains suitable western gray squirrel habitat. The western gray squirrel is suspected to occur within the project area.

Neotropical Migratory Birds (NTMB)

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 January 2000 USDA Forest Service Landbird Conservation Strategic Plan, followed by Executive Order 13186 in 2001, in addition to the Partners in Flight (PIF) specific habitat Conservation Plans for birds and the January 2004 PIF North American Landbird Conservation Plan all reference goals and objectives for integrating bird conservation into forest management and planning.

In late 2008, a memorandum of understanding (MOU) between the Forest Service and the U.S. Fish and Wildlife Service to promote the conservation of migratory birds was signed. The intent of the MOU is to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the Fish and Wildlife Service as well as other Federal, State, tribal and local governments. Within the National Forests, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for land management activities. Opportunities to promote conservation of migratory birds and their habitats in the project area were considered during development and design of the Beaverslide Project (MOU Section C: items 1 and 11 and Section D: items 1, 3, and 4).

The Beaverslide Timber Sale Project is located within Trinity County where 107 migratory bird species are known to occur. Presence or absence of wildlife species in the project area is based on the known range of each species, habitat suitability, records in the Six Rivers National Forest Wildlife Sighting Database, Lower Mad River watershed analyses, the Forest's geographic information system vegetation and wildlife species layers, incidental observations, and formal surveys. 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. The project area consists primarily of forested habitats but also contains a small amount of aquatic and riparian habitat along the lower Mad River.

There are 36 neotropical migrant bird species known or suspected to occur within the project area. Subsets of these species include flammulated owl, Vaux's swift, red-breasted sapsucker, Hammond's flycatcher, brown creeper, western tanager, and black-headed grosbeak, which are also considered management indicator species (MIS) and were addressed in the Management Indicator Species section.

Neotropical migrant bird surveys are not routinely conducted on the Mad River Ranger District so breeding bird populations are unknown. Therefore, presence of habitat is the best measure of possible breeding pairs within the Beaverslide project area. For the Beaverslide Project, the following was considered during project design (see the Alternatives section in Chapter 2 and Vegetation section in Chapter 3):

- No wetland habitat would be managed or altered in any way for any of the action alternatives. This would protect neotropical migrant bird species dependent on wetland habitats.
- Forested habitat would be managed as follows:
  - About 27 percent of the area would be thinned.
  - No late-mature or old growth would be treated.
  - With exception of regeneration planned for 205 acres in Alternative 3, all acres would be thinned from below to favor trees within the upper crown with the focus being retain the largest trees with the best crowns. Treatments are designed to maintain the existing native species diversity, including hardwoods, in the units being treated.
  - Under Alternative 3, 205 acres are proposed for regeneration, which is 1.5 percent of the 13,241-acre project area. By design, no regeneration treatments would occur in late-mature or old growth stands, high-quality northern spotted owl habitat, riparian reserves, or late-successional reserves.
  - Spatial arrangement of the thinning units for all action alternatives was a consideration in designing the Beaverslide project in an effort to reduce fragmentation. Conversely, expansive blocks of forested habitat proposed for thinning were also avoided in consideration of avian species and all other wildlife species that inhabit the project area. Units made up of habitat that was determined to be of “high quality” after ground-truthing was eliminated from any treatment in the Beaverslide project area.
  - Riparian reserves were designated with no treatment in the inner half of the reserve width. The following design features are common to all of the action alternatives and were considered for the protection of neotropical migrant birds in project design.
    - Temporary road crossings within riparian forest habitat would be removed and recontoured at the end of project activities.
    - Landings would be located outside of riparian forest habitat with no wet areas or true riparian areas within 75 feet of the landing, except for unit 59, where an existing landing is located within a riparian reserve.
    - Thinning or fuel reduction treatments could occur within the outer width of riparian reserves. An average canopy closure of 60 percent or greater would be maintained within the treated portions of the reserves.
    - No firelines would be constructed in riparian forest habitat.
  - No open habitat would be impacted by the implementation of any of the alternatives proposed for Beaverslide other than possible placement of landings; this would mainly be a temporary disturbance issue. No open habitat would be removed.
  - Existing system roads were considered when determining harvest units for treatment under the action alternatives. Silvicultural prescriptions determined which stands

were available for thinning or regeneration, but consideration was given to access, either through existing roads or temporary roads, when designing the project. Placement of landings also was considered. Northern spotted owl and goshawk nesting/roosting habitat was avoided during planning for the location of landings and temporary roads.

The project would not adversely impact migratory landbird species or their associated habitats. Potential impacts to migratory species would be minimized through the adherence of LRMP standards and guidelines for snags and down woody debris, riparian reserve buffers, limited ground disturbance, and maintenance of canopy closure. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. Specific project design criteria include, canopy closure would be maintained at 60 percent or greater within northern spotted owl nesting/roosting habitat, vegetation species diversity and composition would be maintained, no management would occur in the inner half of designated riparian reserves, and retention of snags and downed logs would be retained at LRMP levels. Any snag felled for safety reasons would be left on site as downed woody debris. Additional cull logs would be left on site from the logging operation as well. All riparian reserves within the project were identified and buffers established. In addition, no operations would occur during the wet weather season.

Fisheries

Affected Environment

The streams within the project area consist of fish-bearing and non-fish-bearing perennial, intermittent, and ephemeral streams. These streams feed into the Mad River above Ruth Lake. Ruth Lake is cut-off from the Mad River below by Matthews Dam. This dam prevents the upward migration of steelhead. Anadromous runs of Chinook and coho salmon are also found within the Mad River; however, their migration is limited by Bug Creek Falls, approximately 27 miles below the Matthews Dam.

Deep Hollow and Lynch Creek are perennial fish-bearing streams in the northern portion of the project area (Thorton pers. comm.2009). Smith Creek, Armstrong Creek, Van Horn Creek, Secret Gulch, the Upper Mad River, and the South Fork Mad River are intermittent fish-bearing channels (Thorton pers. comm. 2009, Six River National Forest 2003). Most of these streams become intermittent during the summer months, with isolated pools remaining. Stream surveys conducted in 2003 found that conditions were similar to those reported during 1970s stream surveys. These creeks have been impacted by existing and closed roads, timber harvest, and cattle grazing. The Mad River is considered an impaired river with a Federal Clean Water Act (CWA) 303(d) designation because of the river’s high levels of sediment.

There are no threatened, endangered, proposed, or sensitive fish species within or adjacent to the Beaverslide project area. Streams within the project area contain rainbow trout

(*Oncorhynchus mykiss*). The upper Mad River also contains bass and crappie. During a 2003 survey, young of the year and one-year-old trout were observed in isolated pools in most of the intermittent streams. Ruth Reservoir, downstream of the project area, contains black bass, rainbow trout, black crappie, largemouth bass, smallmouth bass, bluegill and brown bullhead, green sunfish, golden shiner, and the Humboldt sucker.

Rainbow trout are part of the River/Stream/Creek assemblage, designated as a forest management indicator species (MIS). This species can be residents of streams, as is the case in the Beaverslide project area, or anadromous, residing in streams as juveniles and then migrating to the ocean. Rainbow trout reside in cool, fast-moving streams with adequate cover (riparian vegetation or undercut banks) and invertebrate food sources (Moyle 2002). The nature of streams within the project area, drying to isolated pools, can lead to stressful conditions (decreased oxygen, increased competition, and increased predation) for the fish present in the isolated pools.

Fish Populations

Information about populations within the project area is limited. Information about fish distribution comes from the Upper Mad River Watershed analysis (Wolff et al. 1998), a fish distribution map, and visual surveys (1970s, 2003, and 2008). During the 2003 survey, a two-person team walked those tributaries historically identified as containing resident trout habitat to assess current conditions, as well as those that have relative ease of livestock entry to channels. Surveys conducted in 2008 visually surveyed intermittent and perennial channels within the project area assessing flow, water persistence during the dry season, and the presence or absence of fish.

Table 29. Summary of named streams and rivers in project area, fish-bearing status, fish species, and summer flow conditions

Stream name	Fish bearing (Y or N)	Fish species
Deep Hollow	Y	rainbow trout
Lynch Creek	Y	rainbow trout
Smith Creek	Y	rainbow trout
Van Horn Creek	Y	rainbow trout
Armstrong Creek	Y	rainbow trout
South Fork of the Mad River	Y	rainbow trout
Upper Mad River	Y	rainbow trout, bass, crappie
Secret Gulch	Y	rainbow trout

Desired Condition

The LRMP desired condition for riparian areas (LRMP p. IV-45) is the following:

- water temperature, sediment loads, and nutrient cycling will be at levels that provide for productive riparian and aquatic ecosystems.
- In-stream flows and fluvial processes will occur at the rates under which the stream system evolved.
- Habitat diversity, channel stability, and water quality will be high.

- Large woody debris recruitment rates will be sufficient to maintain suitable stream habitat conditions.
- Riparian vegetation and nearby lower slope terrestrial plant communities will have a diverse multi-storied structure and provide shade and maintain microclimate in the riparian corridor.

Riparian reserves for fish bearing streams consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest (LRMP, p. IV-44).

A site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site class. Intermittent streams are defined as any nonpermanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria. (LRMP p. IV-45)

Environmental Consequences

Alternative 1

Direct & Indirect Effects

There would be no direct effects to the management indicator species rainbow trout with this alternative. Indirect effects to rainbow trout could occur if there were a wildfire, which can increase the sediment input into streams and decrease overstory cover, thereby increasing turbidity and stream temperature.

Cumulative Effects

Effects would continue from existing roads, culverts, and other road-related structures continuing to input sediment into streams. All roads and road-related structures are on National Forest land. The Little Doe/Low Gulch timber sale will be occurring to the northwest of the project area and the Kelsey Peak timber sale is planed to the east, both on National Forest land; however, because of riparian reserves and design features, little to no effect to the fish assemblage of this project area will occur from the Little Doe timber project. There should be little to no cumulative effects with this alternative.

Alternatives 3, 4 and 5

Direct & Indirect Effects

There are no direct effects from any of the action alternatives to rainbow trout or their habitat because all activities associated with this alternative would take place outside of rainbow trout habitat.

Timber harvesting, fuels removal, road construction and decommissioning are all actions that could have indirect effects on aquatic species and their habitat. Canopy removal can increase stream temperatures. Activities associated with timber harvest and fuel reduction can disturb the

soil leading to an increase in sediment inputs into streams. However, the riparian reserves and other design criteria should minimize sediment inputs into fish-bearing streams from these activities. In-stream flows should not be affected by actions associated with this alternative (see Watershed Report). Therefore, seasonal habitat for juvenile and adult rainbow trout should not change.

Maintenance of existing roads could result in additional sediment delivery to the stream during the first few large rain events. Road reconstruction and maintenance would also result in improved road drainage and reduced chronic sediment delivery to the stream network compared to the current condition and lower the risk of larger road failures due to nonfunctioning culverts. Construction of new roads could also lead to a short-term increase in erosion inputs; however, most of the new roads are outside of the riparian reserves except for new road 34-1 that crosses two draws. Decommissioning of roads could lead to short-term sediment inputs from fill removal. However, over time this short-term sediment input would lead to a long-term improvement in the sediment regimen (see Watershed Report, Thornton 2009).

Increases in short-term sediment input could impact individual rainbow trout. Increased sediment can decrease an individual trout's ability to see prey and therefore decrease its opportunities for capturing larger prey. Increased sediment can decrease the availability of appropriate-sized spawning gravel as well as decrease the oxygen available to eggs still in. This increased sediment effect would likely not last over the long term.

Cumulative Effects

The Little Doe/Low Gulch timber sale will be occurring to the northwest of the project area and the Kelsey Peak timber sale is planed to the east, both on National Forest land; however, because of riparian reserves and design features, little effect to the fish assemblage of this project area will occur from the Little Doe and Kelsey Peak timber project.

Considering the sum of project-related direct and indirect effects, combined with existing and reasonably foreseeable effects from other activities within the analysis watershed(s), these alternatives may impact individual rainbow trout at the project-level scale but there would be no loss of rainbow trout population or habitat viability at 6th-field or larger scale. This determination was made because of the short time duration of indirect and cumulative effects, the design criteria, and riparian reserves that should mitigate any other effects.

Survey-and-Manage Species

The action alternatives of the Beaverslide Project would be consistent with the January 9th, 2006 court order, NEA et al. vs. Rey et al. (Civ. No. 04-844P) and management direction within Memorandum 2670 (FS)/ 6840 (BLM) (OR-931) dated February 22, 2006. These documents require that ground-disturbing activities comply or demonstrate consistency with the 2001 Record of Decision (ROD) and Standard and Guidelines for Survey-and-Manage Species (USDA and USDI 2001) as amended by the 2003 Annual Species Review, Table 1-1, titled "Species Included in Survey and Manage Standards and Guidelines and Category Assignment December 2003".

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

Survey-and-manage Fauna

For fauna, the Beaverslide Project is in full compliance with the 2001 ROD, as updated by the ASR. The habitats and ranges for the following mollusk species: *Deroceras hesperium*, *Hemphillia pantehrina*, and *Mondadenia chaceana*, do not correspond with the Beaverslide project area[4]. Therefore, no strategic or equivalent effort surveys are required. The Del Norte salamander is no longer managed as a survey-and-manage species as updated by the ASR. The Beaverslide project area is outside the range of the Siskyou mountain salamander (*Plethodon storrmi*;) and no equivalent effort surveys were required. No other survey-and-manage fauna species occur within the Beaverslide project area (Ray 2009).

Survey-and-manage Flora

From a botanical perspective, the project complies with the 2001 ROD in that (a) pre-disturbance surveys were conducted for Category A or C species with ranges and potential habitat overlapping the project area, (b) measures are provided for the persistence of the species detected, and (c) management is provided for known sites of Category B or E species (Table 30).

Table 30. Category C and E survey-and-manage species in 2001 Table 1-1 (as amended) detected as a part-of pre-disturbance surveys and Category E species known to the project area

Category	Species	Species group
C	Mountain lady's slipper (*Cypripedium montanum*)	Vascular plant
E	*Dendriscocaulon intriculatum*	Lichen

Ten occurrences of mountain lady's slipper were located during the course of pre-disturbance surveys. This species is also sensitive and as such is addressed in the botanical biological evaluation/biological assessment (Hoover 2009) and sensitive species section of this document.

Review of the known sites database associated with the survey-and-manage species indicated the presence of two known sites of *Dendriscocaulon intriculatum* found in association with surveys of the Mad River Community Protection Project (MRCCP). Beaverslide fuels units and fuel corridors running along Forest Service Route 2705 (Mad Ridge) are coincident with units of the MRCPP. In the course of reflagging buffers, an additional site was found.

Dendriscocaulon intriculatum grows on the bole and branches of oak trees. As a lichen, it exchanges water and gases through its "skin" and thus is influenced by changes in atmospheric moisture. Lichens are most susceptible to changes in their environment when the thallus is hydrated. In this condition, lichens are most photosynthetically active; conversely, no gas

[4] http://www.blm.gov/or/plans/surveyandmanage/SP/Mollusks/terrestrial/appendices/a2.htm

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 microhabitat (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.

In light of these ecological variables associated with lichens, the project includes design features that attempt to reduce potential negative effects of heat and smoke as well as maintain residual substrate for *Dendriscocaulon intriculatum*. A 0.2-acre buffer (radius approximately 50 feet) was established around the occupied substrate in fuels unit 32 and unit 102, and on the edge of a fuel corridor east of unit 32. These buffer areas are no disturbance buffers. In addition, habitat retention was ascribed in the MRCCP in association an area termed “manage area.” Within this area, retain scattered oak and maple trees (about every 40 to 50 feet) less than 12 inches in diameter throughout this manage area (see Project Design Features in Chapter 2 for more detail).

With the project design features in place for all action alternatives for both documented mountain lady’s slipper and *Dendriscocaulon intriculatum* occurrences, measures have been provided for persistence of the species at known sites. Therefore, all action alternatives are consistent with the 2001 ROD as amended.

Botany

Prefield and Reconnaissance Analysis

The pre-field analysis included review and consideration of 1) the Forest sensitive species database and associated spatial layers of known occurrences relative to the project area, 2) geographic information system (GIS) spatial layers of the vegetative subseries and stand age in which the project occurs, 3) elevation gradient of the project area, 4) land-use history, 5) aerial photo interpretation, and 6) professional knowledge of sensitive species habitat and distribution on the Forest. Based upon the presence of potential habitat from spatial layers and aerial photography review followed up by field reconnaissance, approximately 1,920 acres of the 2,400 unit acres (68 percent) were surveyed for vascular sensitive species. Units or portions thereof not subject to survey were plantations, portions of natural stands characterized as even-aged early mature stands with little stand structure and units within vegetation types not considered suitable for sensitive species.

Units with suitable habitat were surveyed by staff botanists from June 2 to August 18, 2008. 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 after year to make surveys feasible, to the features of the project, which are designed to retain habitat components for fungi. Table 31 displays the results of the pre-field analysis determining which species would be further analyzed and the determination of that analysis for all action

alternatives. Table 32 lists survey results of what species were detected and where they were found (for a more detailed analysis see Biological Assessment/Evaluation, Hoover 2009)

Table 31. Botanical sensitive species considered for the project and determination of effects

Common name	Scientific name	Taxonomic group	General habitat	Determination for all action alternatives
Mountain lady's slipper1	*Cypripedium montanum*	Vascular plant	Mid seral and older conifer forest	No Effect
Fascicled lady's slipper	*Cypripedium fasciculatum*	Vascular plant	Mid seral and older conifer forest	Does not occur within the proposed commercial harvest units, fuels treatment units, or the fuels corridor.
Small flowered calycadenia	*Calycadenia micrantha*	Vascular plant	Dry, open , rocky ridges, hillsides, talus	Does not occur within the proposed commercial harvest units, fuels treatment units, or the fuels corridor.
Tracy's sanicle	*Sanicula tracyi*	Vascular plant	White oak woodland, Black oak	May affect individuals but are not likely to result in a trend toward Federal listing or loss of viability.
N/A	*Dendrocollybia racemosa*	Fungus	Mid seral and older conifer forest	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.
N/A	*Phaeocollybia olivaceae*	Fungus	Mid seral and older conifer forest	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.
N/A	*Sowerbyella rhenana*	Fungus	Mid seral and older conifer forest	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.

1 Species is a "survey-and-manage species" and is also included in the Survey and Manage section below.

Survey Results

There are no federally listed or proposed plant species associated with the Beaverslide project area. Surveys resulted in finding sensitive species: 10 new occurrences of mountain lady's slipper primarily associated with commercial harvest units, and three occurrences (one new) of Tracy's sanicle in association with an area of the fuel treatment corridor (Table 32). All known populations are protected by avoidance by either modifying unit boundaries or by buffering interior populations (those nested in a given unit). No other sensitive plant species were located within the proposed commercial harvest units, fuels treatment units, or the fuels corridor. An in-depth plant and fungi analysis can be found in the Biological Assessment/Evaluation by Hoover (2009).

Table 32. Forest sensitive species detected or known to occur in or adjacent to proposed Beaverslide units, fuels treatment units, or fuels corridors

Species	Taxonomic group	Number of occurrences	Units	Fuel treatment corridor
Mountain lady's slipper	Vascular plant	10 (all new)	Within units: 75 & 93a Adjacent to units: 40, 43, 64a, 64b, 72, 89, 101, 103	Yes-between units 40 and 43 (3S05), an extension of occurrence in unit 43
Tracy's sanicle	Vascular plant	3 (2 existing)	Within fuels units: 151; adjacent to unit 2d	Yes- 27N34

Mountain Lady's Slipper (*Cypripedium montanum*)

Mountain lady's slipper is found in a broad range of habitats throughout the western United States and Canada. In California, there are roughly 200 populations of mountain lady's slipper, however, between 50 to 70 percent have not been visited in the last 5 years (Kaye and Cramer 2005). Including the detections associated with the Beaverslide Project, there are currently 13 populations of mountain lady's slipper on Six Rivers National Forest. These populations extend from the Orleans Ranger District to the Mad River Ranger District.

Habitat attributes related to aspect (northerly), canopy cover (greater than 60 percent) and seral stage (mid-mature and older), and the population sizes (fewer that 10 stems) in the project area are in keeping with those attributes ascribed the species by Kaye and Cramer (2005) in the Region 5 Forest Service Conservation Assessment for this species. In addition, since this species requires the presence of a fungus in its early stage of development, the presence of host trees and organic matter that favor fungal associations are also critical habitat elements.

Conditions conducive for the health of existing mountain lady's slipper populations are those that provide for partial canopy cover, native understory and forest floor species associates, host species for mycorrhizal fungi and organic matter cover on the forest floor that sustains the fungus, and suitable habitat surrounding the parent population for subsequent recruitment. Project design features to support these conditions are defined in Chapter 2 of this document.

Direct and Indirect Effects

All action alternatives of the Beaverslide Project would have no effect on the mountain lady's slipper based on the following:

- Buffers for each occurrence were established in the field. No activities would occur in these buffers; therefore, there would be no direct effects.
- In terms of indirect effects, the buffers were delineated in the field to account not only for protection of the plants but to account for habitat elements associated with mountain lady's slipper, specifically overstory shading and existing canopy layers, existing moisture conditions, maintenance of coarse woody debris, maintenance of existing tree, shrub and forb diversity, and adequate habitat around the existing plants for short-range dispersal of seeds and rhizome.

- Edge effects associated with a clearcut edge would not occur. All associated treatments would be from thinning. The established buffers are within the gradient of potential edge influences and the effectiveness of a given buffer adjacent to a thinned stand is increased compared to an edge that has been clear-cut.
- The three mountain lady's slipper populations are located on lower one-third slope positions, on northern slopes, and often near riparian areas, and buffers extend from 152-235 feet beyond the two and three plant clusters. Due to these factors, and the apparent tolerance to a degree of canopy opening, this reduces the significance of any potential edge effects to a negligible level and thus any indirect effects on mountain lady's slipper.

Tracy's Sanicle (*Sanicula tracyi*)

Tracy's sanicle is endemic to the Mad River Ranger District and surrounding non-Federal lands that extend from the Pilot Creek Watershed at the north end of its range to the Upper Mad and North Fork Eel Watersheds to the east and south, respectively. Given the relative widespread distribution of this species, a Conservation Strategy (Hoover 1999, 2008) was developed to conserve and manage select subpopulations of Tracy's sanicle across its range.

Two previously documented occurrences are within the project area. Although not targeted for survey efforts due to the terms of the Conservation Strategy (Hoover 1999), a new Tracy's sanicle occurrence was located during the course of 2008 surveys in Unit 2 and added to the strategy (Hoover 2008). All known populations are protected by avoidance by either modifying unit boundaries or by flagging of interior populations.

Table 33. Tracy's sanicle population and habitat attributes in the project area

Unit/area	Est. No. of plants [a]	Vegetation subseries		Issues
151 [b]	20	Douglas-fir-Black Oak	White oak-Ca. Fescue	Overtopping, encroaching conifers
2 [b]	30	Douglas-fir-Black Oak	White oak-Ca. Fescue	None identified
27N34 Fuel Corridor	11	Douglas-fir- White Oak		Yellow starthistle nearby, evidence of livestock presence

a Estimate is low due to survey dates (early-mid July) when juveniles were no longer present
b Boundaries of these units have been changed to avoid Tracy's sanicle conservation areas

Potential threats to Tracy's sanicle associated with project activities pertain to extent of canopy opening on the perimeter of Tracy's sanicle conservation areas (which could displace the native floral associates and allow for spread of noxious weeds into the area), extent of existing conifer encroachment present in the areas, and the overtopping (and ultimate mortality) of oaks by Douglas-fir in these areas.

Direct and Indirect Effects

All Tracy's sanicle occurrences within the project area are a part of the Conservation Strategy and as such are managed to alleviate negative impacts, both direct and indirect, related to project activity implementation (Hoover 2008). The occurrences within the Conservation Strategy have been delineated to provide a habitat buffer around plants or plant concentrations. Most often the conservation area coincides with the oak woodland polygon in which the occurrence is documented or incorporates black oak concentrations for those occurrences in the Douglas-fir-Black Oak sub-series.

Tracy's sanicle conservation areas occur in the project area in relation to commercial thin unit 2, fuels unit 151, and a fuels corridor. Boundaries for units 2 and 151 have been changed to avoid the Tracy's sanicle conservation areas completely. By virtue of their location outside the unit boundaries and the design of the conservation area to incorporate a habitat buffer, direct and indirect negative effects to Tracy's sanicle related to project implementation are not expected for these two conservation areas.

In the conservation area adjacent to fuels unit 151, management issues pertaining to encroachment and overtopping by Douglas-fir was identified (see Table 33). Although not within the unit, project design features provide for habitat enhancing opportunities under the guidance of the botanist. Overtopping Douglas-fir and thinning of saplings would avoid direct impacts to plants when feasible but incidental impact to a small number of plants may be unavoidable. These impacts would not be considered significant. Habitat enhancing activities (indirect activities) are expected to benefit Tracy's sanicle in that conifer encroachment would be set back and mortality of oaks due to overstory conifer shading would be reduced.

While conservation areas are designed (size and dimension) to protect against impacts from Forest activities on its margin, existing habitat conditions at the time of area establishment may preclude the intent of the area design. The conservation area nested in the fuel corridor along 27N34 is an example. During the course of surveys for this project, yellow starthistle was mapped at two locations proximal to the boundary of the conservation area. At both sites, yellow starthistle has spread beyond the road edge into the adjacent open habitat. One site is estimated at 0.5 acre and the other infestation covers 2 acres.

Specific activities by fuel corridor have not been prescribed. Activity options include cutting understory vegetation, thinning trees less than 12 inches in diameter, tree pruning and mastication. As a part of the project design to reduce the risk of spreading noxious weeds, mechanical equipment (such as the masticator) is prohibited from areas with documented yellow starthistle (see p. 25), therefore; hand treatments are the only option in the fuels corridor adjacent to the Tracy's sanicle conservation area.

Removal of small trees and shrubs in the fuel corridor would remove cover, remove competing vegetation, and open up the habitat enough to increase the risk of spread from yellow starthistle's current location. Depending on the current canopy cover on the margins of the conservation area, yellow starthistle could ultimately make inroads into the conservation area

where conditions are suitable for the species. Spread of yellow starthistle into the area would displace the native flora including Tracy's sanicle.

Based on this analysis, all action alternatives of the Beaverslide Project may affect individuals, but are not likely to result in a trend toward Federal listing or loss of viability.

Sensitive Fungi Species

Little if any information is known about management effects to a particular sensitive fungus; therefore, species will be addressed in the context of their particular habit and ecological function. The three fungi species listed that may occur within the project area can be divided into three groups: saprobic, mycorrhizal and parasitic. *Sowerbyella rhenana* 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. *Phaeocollybia olivaceae* is mycorrhizal. Mycorrhizal fungi form interdependent relationships with their host tree, exchanging nutrients, mineral and water. *Dendrocollybia racemosa* is parasitic on decaying fungi.

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). Networks of fungal hyphae or mycelia (the body of the fungus) group together into strands. These networks scavenge nutrients from the surrounding soils, acting as an extension to the root system. These 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 retains living trees (the host) and the important underground linkages for mycorrhizal fungi via the mycelial network will maintain habitat parameters for mycorrhizal species (Amaranthus and Perry 1994). Likewise, management that retains overstory canopy and the litter and coarse woody debris of the forest floor will maintain habitat parameters for saprobes (Norden et al. 2004). Factors considered when assessing risk to sensitive fungi were overstory shading, presence of host trees or shrubs, and presence of litter, duff and coarse woody debris.

Direct and Indirect Effects

Surveys were not conducted for sensitive fungi due to their ephemeral habit and the expected retention of habitat components important to most fungi across the units. Effects are measured by the magnitude of changes in the habitat resulting from project implementation, and by activities that may cause new disturbance associated with mid-mature stands. This age of stand is more likely to support sensitive fungi compared to stands of an early age or even-age with little structure. Pockets of late-mature trees nested in early seral stands may also support sensitive fungi; however, sites or areas of late-mature trees are not scheduled for treatment. None of the fuels corridors or fuels units are considered suitable habitat for sensitive fungi.

Thirty-four percent of the unit acreage to be treated is within the mid-mature seral stage. Ground-disturbing activities across these acres include thinning of overstory trees using tractor,

skyline and helicopter methods, yarding of trees from the unit, treatment of activity fuels (lop and scatter, pile and burn, and jackpot burn), and development of new landings, skid trails, and temporary roads. Of the activities proposed in mid-mature stands, ground-based logging systems (affecting an estimated 20 percent of the acreage to be treated), skid trails, skyline corridors, and development of temporary roads and landings are the types of activities that could affect fungi habitat by displacing forest floor organics, and in the case of new landings, corridors and roads, could remove canopy cover.

Direct and indirect negative effects of these activities pertain to:

- removal or severance of mycelial components (which comprise the fungal organism) residing in the organic or topsoil layer for mycorrhizal fungi,
- reduction in canopy shade and organic forest floor cover,
- reduction in the abundance of host trees and refuge species to sustain inoculum through periods of successional change in the stand,
- removal or reduction of forest floor organics and coarse woody debris which form the primary micro-habitat for saprobic species, and
- breakdown of soil structure (e.g., compaction) which not only affects the mycelia therein but also damages fine root tips to which the mycelia attach (Amaranthus et al. 1996).

To reduce the potential and magnitude of negative direct and indirect effects associated with implementing activities, the desired stand attributes would be retained by project design (for a complete list, see Connected Actions Associated with the Action Alternatives in Chapter 2):

- Low thinning of trees and layered canopy structure that retains canopy cover
- Predominant and dominant conifers
- Diversity of potential host trees (i.e., sugar pine, ponderosa pine, oaks and madrone)
- Patches of forest floor organics and coarse woody debris
- Limiting skid trails to 15 percent of the unit, retaining 90 percent soil porosity over 85 percent of the unit area, and retaining 50 percent of the litter and duff layer over the unit area, would reduce the extent of mycelial damage, damage to the soil structure and the displacement of forest floor organics.
- Retaining all large snags within treatment units and logs greater than 20 inches where deficit provides an important habitat element for fungi.
- In northern spotted owl habitat, maintaining a post-project canopy closure of 60 percent or greater to maintain moisture.

While not eliminating effects to fungi, it is assumed by managing for habitat elements in stands to be thinned, adverse effects to sensitive mycorrhizal and saprobic species can be reduced. Effects of relatively small-scale activities are not likely to significantly reduce the fungal species diversity that was in place prior to the disturbance (Durall et al. 1999, Hagerman et al. 1999). In certain areas in a stand, microhabitat features would be impacted by skidding, felling of canopy

trees, yarding tops, and end-lining or pile burning. However, mycelial networks can extend several meters through the forest floor, so localized impacts may impact or sever part of the fungal individual but would not necessarily impact the entire body of the organism. Furthermore, if vegetative and soil conditions are retained in places within the unit, spores stored in the soil provide a propagule for development of fungi after the disturbance. These impacted areas would recover in time and along with it the development of fungal communities (Dahlberg and Stenlid 1995).

Based on this analysis, all action alternatives of the Beaverslide Project may affect individuals, but are not likely to result in a trend toward Federal listing or loss of viability of any of the three sensitive fungi species.

Cumulative Effects of Sensitive Species

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

In keeping with the spatial scale, the temporal context for assessing past activities would coincide with the timing of those activities. Information on timber projects on public land in the project area date back to 1960s. The North Fork Eel Grazing Allotment has also been in place over this span of time but areas of grazing activity do not coincide with fungi habitat so range management will not be addressed further.

Wildfires have occurred in the past and will continue into the future. While mixed-severity wildfire was the norm historically, current and likely future stem densities and fuel arrangement are 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 (Schantz 2009). Stand-replacing wildfires would affect essential habitat elements for sensitive fungi by removing canopy, diversity of host trees, and forest floor organics.

Logging has occurred on private land within the planning area. Single-family residences and agricultural developments have also occurred and will likely continue to occur as well as ongoing road maintenance by the Forest Service and County. Detailed information on these types of developments and activities is not available for this project; therefore cumulative effects of these developments and activities on sensitive species will be addressed in generalities.

The only foreseeable future activities on National Forest lands (besides wildfire, which is addressed above) are those associated with continued implementation of the Mad River Community Protection Project and the Access Travel Management Plan for the District.

Mountain Lady's Slipper

With the project design features in place, this project is not expected to result in any direct or indirect effects to mountain lady's slipper; therefore, there would be no cumulative effects posed by implementation of this project.

It is recognized that factors outside the geographic scope of this project have influenced local populations elsewhere on the Forest. Past activities appear to have extirpated at least some of the historical occurrences on the Forest. The loss of historic occurrences (or inability to relocate them), and the small number of plants per occurrence on the Forest coupled with the added effects of future high-intensity wildfire and risk of incidental damage to populations with very few plants (e.g., livestock trampling), does increase the vulnerability of the extant populations to local extirpation.

Tracy's Sanicle

Past management activities have affected occurrences of Tracy's sanicle. Given the number of extant occurrences in the past and current conservation under the strategy which applies to past projects over the last 10 years and foreseeable future projects, compromised or completely altered habitat due to past Forest Service actions is not considered significant; however, successional trends may be approaching a threshold where active management within the conservation areas is needed to realize the goal of the Conservation Strategy. Under the strategy, a network of occurrences of sufficient size and condition as well as spatial distribution was established to support persistence of the metapopulation over time and space. While a project design feature to address conifer encroachment is in place for the Beaverslide Timber Sale, monitoring across the range of Tracy's sanicle indicates that persistence will warrant active management (e.g., thinning, prescribed burning) in a number of conservation areas to curb the successional trend favoring conifers.

Sensitive Fungi

Past activities associated with clearcuts, patch cuts, shelterwood or seed tree cut, landing development, road construction, areas of stand-replacing wildfire, and clearings relative to private land development have contributed cumulative effects to sensitive fungi. These activities have removed or notably altered habitat for sensitive fungi. While local extirpations may have occurred, these losses would not constitute a trend toward federal listing or loss of viability due to a) the potential for sensitive fungi to occur in undisturbed stands surrounding the logged or intensely burned area, b) the ability of spores to move into a disturbed area from the surrounding forest and persist as mycelia underground and c) the broad geographic distribution of these species south of the project area and into the Pacific Northwest.

Noxious Weeds

Affected Environment

In 2003, the U.S. Forest Service identified invasive species, which includes noxious weeds, as one of four critical threats to the nation's ecosystems. Invasive species can be aggressive invaders of native plant communities and are capable of dominating native habitat types, excluding native vegetation and their pollinators, depleting soil and water resources, and reducing site diversity and productivity. In light of their high reproductive rate, growth habit, methods of dispersal, and long-lived seed bank capacity, invasive species are opportunistic, aggressive colonizers that readily out-compete and displace native plant species. Once introduced and established, invasive species can persist in the environment indefinitely. By altering native plant communities, invasive species displace forage for livestock and native wildlife, and ultimately homogenize grassland species composition.

Habitats vulnerable to introduction and spread of invasive species are those subject to disturbance where canopy, understory and ground vegetation have been removed. Invasive species have an enormous capacity to spread into these newly disturbed areas and to proliferate. Inadvertent weed introductions are often caused by weed seed imported on equipment or on vehicles that have been operating in an infested area, by using weed-seed-infested gravel or other material, or by seed attachment on the hide of livestock and native ungulates. Introduced weed seed that is exposed to disturbed soil readily germinates, and if left untreated, becomes established and spreads where conditions are suitable. Once established, invasive species can spread from roadside occurrences to interior habitats and, overtime, affect biodiversity on the landscape scale (von der Lippe and Kowarik 2007).

"Noxious weeds" is a category of invasive species that have been determined by the State to negatively impact agricultural land and wildlands. Yellow starthistle is the primary noxious weed in the project area where it is found along with roadsides and previously disturbed areas. This species is a highly invasive, short-lived perennial forb that puts energy into growth of its root system early in the season. This early development allows it to exploit water resources, which increases its ability to outcompete native vegetation. As a shade-intolerant species, typical habitat for yellow starthistle is "open" with little to no canopy cover. One yellow starthistle plant can produce anywhere from 1,000 to 75,000 seeds (DiTomaso and Gerlach 2000) and seed can persist in the environment for up to 10 years. With its abundant seed production, long-lived seed bank and competitive advantage, yellow starthistle readily invades newly or chronically disturbed areas where it then thrives at the expense of other plant species. Currently, it is estimated that 15 million acres of land in California are infested with yellow starthistle (Pitcairn et al. 1998).

Noxious Weeds in the Project Area

Yellow starthistle was documented in open non-riparian settings adjacent to both timber and fuels units and also within fuel treatment corridors where there is little to no existing canopy cover and the ground vegetation is sparse. Other infestations occur in the roadbed, along long stretches of

roadsides, in turnouts, and in association with old landings. Yellow starthistle did not occur in habitats associated with either of the sensitive species detected in the project area, mountain lady's slipper (*Cypripedium montanum*) or Tracy's sanicle (*Sanicula tracyi*). While not detected within the habitat for Tracy's sanicle, yellow starthistle was detected in the grass and shrubland adjacent to one of the populations (see Botany-Sensitive Species section).

The most extensive and densest occurrences in the project area are located in the southern portion of the project area. Specific infestations include:

- Roads: 3S13, 3S13A, 3S13B, 27N42, 27N34D, and portions of 27N34 and 27N44
- Fuel treatment corridors along: 3S05, 3S13, 3S13A, 3S13B, 27N16, 27N34, and 27N34D
- Alongside routes, adjacent to fuels units: 152, 153, 154, 155, 160, 161, 162, and 163
- Along roadsides, adjacent to timber units: 45, 61b, 65, 73, 86, 87a, 87b, 88a, 88b, 94, 95a, 95b, 95c, 95d, 96a, and 97

Treatment Techniques

Yellow starthistle is a Forest priority noxious weed; therefore, when it exists on the landscape as an isolated occurrence or when Forest activities propose a high risk of spreading noxious weeds, the occurrence is managed. Treatment methods typically used on the Forest include manual (hand pulling) and mechanical techniques (weed whacking), application of weed cloth, and revegetation. Manual removal is typically applied when occurrences are small in size (e.g., less than 0.2 acre) and the objective is to completely remove the adult plant and, with follow-up treatments, to manage the seed bank and ultimately contain, or even eradicate the occurrence. Follow-up revegetation techniques or mulching may be incorporated to help stabilize the site.

Mechanical treatment is applied when occurrences are larger in extent. The objective of mechanical treatment is not to remove the plant but to manage the development of the seed heads and to thwart reproductive capacity in a given year. Weed whacking is a form of mechanical treatment. This treatment method removes the spiny seed head of yellow starthistle and thus reduces the incidence of spread where equipment is scheduled to operate. Studies have shown that the most effective mechanical control of yellow starthistle occurs during the early flowering season when approximately 2 to 5 percent of the flower heads are in bloom (Benefield et al. 1999).

An additional treatment method considered in all action alternatives is the application of organic-based herbicides. Organic-based herbicides refer to those products whose active ingredients include citric acid and/or acetic acid at varying concentrations. Both organic acids are GRAS (generally recognized as safe) ingredients listed by the U.S. Food and Drug Administration (2004).

Citric acid is produced naturally by bacteria, fungi, and plants (Owen 2002), and lemon juice contains 4 to 8 percent citric acid (Hoyt and Gewanter 1992). Citric acid is listed with the EPA as an ingredient that is allowed to occur in minimum risk pesticides (U.S. Environmental Protection Agency 2008a). Therefore, under certain conditions, citric acid is exempted from federal registration under EPA regulations (U.S. Environmental Protection Agency Office of Pesticide

Programs 2000, U.S. Environmental Protection Agency 2008a). Acetic acid is produced through the natural fermentation of plant materials containing sugars. Normal household vinegar is 5 percent acetic acid, but organic herbicide products developed to kill weeds contain concentrations of roughly 11 to 20 percent acetic acid. Acetic acid at these high concentrations is not exempted from EPA regulations, and therefore products approved for use must be registered both federally and with the California Department of Pesticide Regulation. These products act as contact herbicides and are approved for use in organic gardening. The high pH concentration for both citric and acetic acid alters the integrity of the noxious weeds' cell membranes, which desiccates the leaf tissues (Webber and Shrefler 2006). Plants are killed when the acid causes the plants' cells to rupture and the plant dries up and dies. If a high amount of product is applied, pH changes in the soil may also contribute to plant death by acting in the same manner on the root system.

Environmental Consequences

The environmental consequences of noxious weed introduction and spread are discussed in terms of indirect effects only in that the effects are an aftermath or consequence of establishment. Indirect effects pertain to the introduction and spread of yellow starthistle and the resultant incremental loss of native plant species, which reduces the capacity of plant communities to provide ecological services—forage for wildlife, water and nutrient cycling, and soil productivity.

Logging-related activities, such as landing and temporary road construction, increase the risk of introduction and spread of yellow starthistle by opening up new habitat for invasions. Road and landing construction are ground-disturbing activities that have the potential to create a very high risk of spread and introduction of noxious weeds by reducing canopy cover and decreasing vegetative competition by native plants. New landing construction increases habitat vulnerability to weed introduction due to heavy equipment operation and ground disturbance. Activities that remove canopy cover create suitable conditions for yellow starthistle to invade. Soil disturbance can stimulate the seed bank and increase germination rates of noxious weed seed. On landings, soil compaction reduces the number of native species that can become established, which gives yellow starthistle, with its deep root system, an advantage in these areas.

Fuels activities may also affect the risk of spread and introduction of yellow starthistle. Brushing, mastication, and other fuel treatments reduce canopy cover (which includes shrub cover) and create openings that further increase the risk of spread of yellow starthistle. Mastication machines can pick up weed seed and spread it during operations.

Approximately 20 percent of the thinning treatments are within northern spotted owl habitat and would retain a minimum of 60 percent canopy cover, which is associated with a low risk of spread of yellow starthistle. Regeneration cutting, however, alters forest structure and removes all canopy cover, even when legacy tree retention is included in the prescription. This type of harvest creates wide, open, exposed, sunny areas in which yellow starthistle thrives. In the absence of competition from vegetation or shade, yellow starthistle readily moves into these areas. As the shrubs regenerate, yellow starthistle becomes shaded out, but roadside infestations remain.

Several scenarios exist by which yellow starthistle may be spread and/or be introduced into previously uninfested areas based on the activities associated with project implementation. Within these scenarios, risk of spread will vary on a gradient from low risk to very high risk of spread, depending on the intensity of ground-disturbance, the extent of equipment used, and the harvest method. For example, a low risk of spread would occur in areas where canopy cover is being maintained and yellow starthistle is not present or adjacent to areas of operation. A moderate risk of spread may occur in areas where yellow starthistle is adjacent and harvest activities are maintaining canopy cover. Activities that represent a very high risk of spread include the use of multiple pieces of heavy equipment where yellow starthistle is present or adjacent, and subsequently operating the equipment in an uninfested area. Temporary road construction requires the use of heavy equipment, and in the project area, 43 temporary roads (8.2 miles) may be constructed, some of which are adjacent to yellow starthistle infestations. In this scenario, risk of spread of yellow starthistle is very high because areas are cleared, canopy is opened, heavy equipment is used, and yellow starthistle may be adjacent.

Given the heavy weed infestation in the south on roads 3S13, 3S13A, 3S13B, 27N34, 27N34D, 27N42, and 27N44, multiple project design features have been developed (see Chapter 2, p. 25). These features would reduce the risk of introduction and spread but are not expected to eliminate risk. The scenarios presented above show a gradient of risk by activity. In some specific areas, under certain scenarios, and depending on variables pertaining to implementation (e.g., timing of weed removal with timing of operations), design features may be inconsequential to reducing the risk from a high or moderate level to a low level.

Direct and Indirect Effects

Alternative 1

Under the no action alternative, there would be no effects brought on by project implementation. Even without new canopy removal, ground disturbance, and clearings, yellow starthistle may still be introduced to the area and if left unchecked existing occurrences of yellow starthistle will spread from their source. Given the circumstances described above about the current distribution of yellow starthistle in the project area and the potential vectors for weed spread outside the scope of this project (i.e., routine road maintenance, private property developments), the extent of noxious weed populations would increase, with the southern portion of the project area being the most vulnerable. Yellow starthistle would spread away from existing occurrences via vehicles, livestock, and off-highway vehicle travel, especially in areas where there is reduced vegetative competition and lowered canopy cover. Infested areas with low canopy cover and areas where infestations occur along roadsides will remain as source areas for the aforementioned vectors to continue yellow starthistle spread and proliferation.

Alternative 3

Indirect effects under Alternative 3 include the risk of spread associated with the use of heavy equipment to construct/reconstruct roads and to develop/redevelop landings (Table 34). These

activities create a high risk of spread of yellow starthistle in the project area. Clearing of vegetation to create landings would cause habitat alterations that favor noxious weed establishment. Machinery and vehicle use in infested areas might directly spread existing yellow starthistle infestations to currently uninfested areas.

Indirect effects may also result from regeneration harvest on 205 acres under this alternative. Yellow starthistle seed that is picked up and transported to areas that are then cut by regeneration harvest, leaving little to no canopy cover, would have a greater likelihood of becoming established. In areas where thinning is proposed, the likelihood of yellow starthistle introduction and establishment is reduced and of relatively short-term duration in comparison to areas where regeneration harvest would occur. Thinnings proposed in stands would maintain a range of canopy cover from an average of 40 in early-mature stands to 60 percent in older stands, whereas regeneration would remove all, or nearly all, of the existing canopy cover. Overstory canopy removal, understory vegetation removal, soil disturbance, heavy equipment use, import of foreign material, and the proximity of known yellow starthistle sites to ground-disturbing activities are all factors that influence the risk or likelihood of yellow starthistle introduction and spread. Variables surrounding these factors pertain to their extent and magnitude. Under Alternative 3, three new helicopter landings and 43 temporary roads (5.3 miles with up to 43 new tractor landings) are proposed (Table 34). New tractor landings would be approximately 0.5 acre in size, while helicopter landings would be larger.

Table 34. Comparison of alternatives by factors that influence the relative risk of noxious weed introduction and spread resulting from project implementation

Alternative	Miles new temporary roads	Miles existing temporary roads	Number of new landings		Number of existing landings	Silvicultural treatment (acres)	
			Tractor	Helicopter		CT	Regeneration
Alt 1	0	0	0	0	0	0	0
Alt 3	5.3	8.2	43	4	89	2,176	206
Alt 4	0	1.7	0	3	89	2,471	0
Alt 5	5.3	8.2	43	4	89	2,471	0

Fuels activities would occur in fuel treatment corridors and in fuels units. Fuels activities do not vary by alternative and therefore carry the same risk of spread and introduction for Alternatives 4 and 5 as they do for Alternative 3. Hand work within fuel treatment corridors and units carries with it a risk of spread of existing yellow starthistle populations if activities are conducted within existing infestations. Hand work itself inherently carries with it a lower risk of spread of noxious weeds than does machine work. Fuel treatments in the understory of mature stands would leave patches of shrubs and trees scattered throughout the unit. The retention of shade and pockets of competing vegetation in the unit as a result of thinning and fuels treatments lowers the risk or reduces indirect effects of these activities on the spread of noxious weeds into the unit to a negligible level.

Project design features have been put in place for this alternative as well as all action alternatives to reduce the risk of noxious weed introduction and spread. Noxious weed control measures that would be undertaken to decrease the risk of introduction and spread include a progression of work scheduled in the operation plan and site treatment, primarily by manual or mechanical means. Where dense and large infestations exist at landings, yellow starthistle would be either treated with a weed whacker or application of an organic-based herbicide.

Organic-based herbicides refer to non-synthetic, natural herbicides composed primarily of either citric or acetic acid. Literature searches have resulted in few studies on the effects of organic-based herbicides on the environment. However, these acids have low toxicity and are biodegradable (P&G 2004; Oregon State University Extension 2008). Studies indicate that these organic acids do not bioaccumulate (Hoyt and Gewanter 1992), and acetic acid readily breaks down to carbon dioxide and water (U.S. Environmental Protection Agency 2008b). Both citric acid and acetic acid may have short-term inhibitory effects on fungal growth, but in the case of acetic acid, the growth resumes post-application (Kang et al. 2003). Most unpublished sources indicate that lowered soil pH effects can last up to a few days (Lerner 2003; Owen 2002). However, in a comparative study, the duration of pH effects from applying organic-based herbicides has been documented for up to one year after application (Radhakrishnan 2003). Other potential effects pertain to non-target species. It is expected that an organic-based herbicide would locally affect non-target species that may coexist with yellow starthistle; however, the plant species on landings are typically non-native annual grasses or forbs, which are widespread and readily reestablish.

The organic-based herbicide would be applied directly to the yellow starthistle using a hand-held sprayer. This application would only occur on previously and heavily disturbed landings and on sections of road where the slope is less than 5 percent, and located outside of water courses, channels or ditches. In light of the restricted use of organic-based herbicides to previously disturbed, flat settings, which are not in contact with water sources or likely to result in off-site runoff, some anecdotal studies and unpublished reports indicating short- versus long-term effects on soil pH, and fungal growth; and the ability of non-target species potentially affected by the application to readily reestablish; environmental consequences of using an organic-based herbicide are not considered significant.

Impacts to human health may occur to applicators of the product if they do not wear proper protective gear. Organic acids at high concentrations can cause eye damage, skin damage with contact, and damage to lungs and mucous membranes if inhaled or to other organs and tissues if ingested. Applicators would be required to wear proper protective gear to avoid potential impacts to human health. With the use of the proper safety gear, the effects to applicators are minimal.

Project design features are described in Chapter 2 on page 25 (also see Noxious Weed Risk Assessment).

Alternative 4

The risk of spread and introduction of weeds remains high under this alternative, as it does under Alternative 3 and the proposed action. Indirect effects remain the same as they are under Alternative 3, with the exception that no temporary roads would be constructed and no regeneration harvest would occur. There are fewer ground-disturbing activities under this alternative, which would diminish the effects of noxious weed spread and introduction.

Because no temporary roads would be built, no new tractor landings would be constructed. This reduces the number of newly constructed tractor landings from 43 to 0, which in turn reduces the creation of settings suitable for weed establishment. Use of existing temporary roads throughout the project may spread yellow starthistle, especially in areas where weed infestation sites are in close proximity to temp roads; however, fewer existing temporary roads would be used in this alternative than under Alternatives 3 and 5 (from 8.2 miles down to 1.7 miles; Table 34).

Under Alternative 4, three new helicopter landings, 89 existing landings, and no new temporary roads are proposed. Fuels activities have the same effects under Alternative 4 as they do under Alternatives 3 and 5. Effects of the use of organic-based herbicides are the same under Alternatives 3, 4, and 5. Project design features aimed to reduce the risk of introduction and spread in place under Alternative 3 apply to Alternative 4 as well.

Alternative 5

Under the revised proposed action, risk of introduction and spread of noxious weeds is high. Yellow starthistle infestations are prevalent in the southern portion of the project area, and activities within these areas would increase the rate of spread for yellow starthistle. Long stretches of roadside infestations already present within the project area would proliferate with ground-disturbing activities. These roadside infestations would contribute to the spread of yellow starthistle within the project area as weed seed is picked up on machinery that is operating in or near the infestations.

Indirect effects remain the same under Alternative 5 as they are under Alternatives 3 and 4, with the exception that no regeneration harvest would occur and temporary roads would be constructed.

Road and landing construction create a high risk of both introduction and spread of noxious weeds. Under the revised proposed action, 43 new temporary roads (5.3 miles total) would be constructed (and approximately 43 new landings associated with these temporary roads would also be constructed). There would be four newly constructed helicopter landings under the revised proposed action alternative. Use of existing temporary roads throughout the project may spread yellow starthistle, especially in areas where infestation sites are in close proximity to temporary roads.

Under Alternative 5, four new helicopter landings (landings 20, 31, 65, 90), 89 existing landings, and 43 new temporary roads (with up to 43 new tractor landings) are proposed (Table 34). With the exception of one additional new helicopter landing in Alternative 5 (4 new

helicopter landings) versus Alternative 3 (3 new helicopter landings), and the indirect effects due to yellow starthistle spread as a result of regeneration harvest, Alternatives 3 and 5 have the same factors affecting the risk ratings of noxious weed introduction and spread.

Fuels activities have the same effects under Alternative 5 as they do under Alternatives 3 and 4. Effects of the use of organic based herbicides are the same under Alternatives 3, 4, and 5. Project design features aimed to reduce the risk of introduction and spread in place under Alternative 3 apply to Alternative 5 as well.

Cumulative Effects

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

In general, past activities associated with a) clearcuts and other logging practices b) wildfire, c) fire salvage on public land, d) landing developments, e) road maintenance activities, f) livestock grazing and g) residential or agricultural related clearings on private land have contributed cumulatively to the introduction and spread of noxious weeds. Foreseeable future activities on National Forest land include the Buck Mountain and Kelsey Peak projects as well as ongoing private land developments and road maintenance. Like past activities that provided vectors and created suitable habitat for weed establishment (i.e., little to no overstory, disturbed ground, little competing vegetation), foreseeable future activities would be expected to continue this trajectory.

Physical Environment

Soils

Affected Environment

The primary management goal of the Six Rivers LRMP is to maintain long-term soil productivity. Soil resources should be managed to protect and enhance long-term productivity of the Forest, and where applicable and practical, restore the productive potential of soils damaged by past events. Recognizing that soil is a fundamental and largely non-renewable resource that is the basis for high-level sustained yields of all other resources, the program emphasis is to avoid or mitigate the impacts of management activities. The Six Rivers National Forest has implemented soil quality standards and standards and guides, which address prevention of soil compaction, soil erosion, maintenance of organic matter and monitoring the soil resource to ensure maintenance of soil productivity (see Soil Report). Six Rivers LRMP standards and guidelines tier to Region 5 standards published in 1995. These standards were applied site specifically through the interdisciplinary process used during project design.

Soil cover from organic material and vegetation in the project area is continuous in most proposed timber units, except where historic roads and landings are located. Many of these soils are major timber producing soils, supporting a relatively high amount of productivity. Soil cover from plants and organic matter in fuels units tends to be less continuous than in the more densely forested timber units, and surface rock or gravel can be more conspicuous in these drier, more open sites.

The project area is located south of Ruth, CA in mountainous terrain. The proposed treatment units are positioned on flat to steep slopes lying between the Mad River to the east, and Mad River Ridge to the west. The area receives an average of approximately 60 inches of precipitation per year, primarily between November and April. Some of this precipitation arrives as moderate amounts of snowfall during the winter months; summers are typically hot and dry.

Soils in the project area are underlain by Franciscan Assemblage parent material, located within the California Coast Range physiographic province. Soil parent materials include sedimentary, meta-sedimentary, and meta-igneous substrates. Typically, Franciscan sediments and meta-sediments in the project area are primarily derived from Late Jurassic greywacke, and small amounts of shale or schist as well as metamorphosed basic igneous rocks. Clallam deep extremely gravelly-Deadwood (3 percent), Clallam moderately deep unstable-Melbourne (4 percent), Clallam-Hugo-Holland deep (18 percent), Clallam-Hugo-Holland deep dry (6 percent), Deadwood-Clallam deep extremely gravelly (1 percent), Deadwood-rock outcrop metasedimentary-Voorhies (21 percent), Doty-Hecker deep (2 percent), Holland-Goldridge deep (5 percent), Melbourne-Soulajule deep (3 percent), Skalan-Kistirn-Holland deep (30 percent), and Typic xerofluvents-riverwash (8 percent) soil associations are found in the project area. Loamy-Skeletal and Fine Loamy taxonomic soil families dominate. Soils textures are loamy, and gravelly or very gravelly epipedons and subsoils are common. The soils in the analysis area tend to be deep and exhibit rooting depths up to 40 to 60 inches or greater. Permeability varies from moderately slow to rapid, and soils are well to somewhat excessively drained. Their general ability to infiltrate water flow is likely attributable in part to the relatively high content of large particle size classes, such as gravel, in the soil.

Existing Condition

Erosion

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). Vegetative cover averaged 69 percent across the project area and cover from organic matter averaged 96 percent. Active signs of erosion such as pedestalling, terracettes, rills and gullies were rare to absent within treatment units. No erosion hazards such as landslides within treatment units were observed. However, a number of problem roads were identified that are currently contributing to

off-site transport of soil and water. For an in depth discussion of these roads, please refer to the watershed section of this report.

Soil cover from live vegetation (typically trees), litter, and duff was generally continuous throughout the more densely forested stands dominated by Douglas-fir trees; except where major skid trails and landings were located. All cover types tended to be patchier where past disturbance was evident. Although soils across the project area tended to be gravelly, surface rock was not very common in the more densely forested sites. Live vegetation appeared to be patchier in areas dominated by gray pine, oak, and shrub communities. Soil surface cover from organic matter appeared less continuous in those areas as well, and consisted of litter or patches of residual dry matter where it was present. Duff was not as abundant and less organic matter was incorporated into the soil surface horizons of the woodland and shrub communities, but surface rock and gravel were more apparent. The woodland and shrub vegetation types tended to have a more open foliar canopy, a larger component of shrubs, and a more diverse herbaceous plant community than the Douglas-fir forests within the project area.

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. By comparison, grey pine, oak, and shrub vegetation communities did not form the same closed canopy over the soil; therefore, they did not contribute the same kind and amount of litter necessary to form a complete layer of organic material atop the soil surface.

The forest floor under Douglas-fir dominated stands was covered with needle cast, and more woody litter compared to the soil surface in woodland and shrub stands where leaf litter from shrubs and residual dry matter from annual herbs and grasses exist in higher proportion to conifer needles or woody material. Woody plant material and needle cast tend to be more recalcitrant to weathering than herbaceous material, potentially contributing to a longer residence time of litter on the soil surface that would allow for greater accumulation over time and creation of continuous organic layers. Additionally, the litter that falls in more open and exposed stands of grey pine, oak, and shrubs may be cycled through the soil faster than litter under closed canopy Douglas-fir forest due to warmer soil temperatures that could potentially accelerate nutrient cycling.

Annual grasses and herbaceous vegetation formed patchy ground cover within woodland and shrub stands and are effective at impeding surface run-off depending on their density. Climatic factors can have a profound effect on annual grass production such that cover of live vegetation will vary much more compared to stands where perennial species like evergreen trees dominate. Residual dry matter left behind as annual plants senesce may also be a more temporary source of protection because the herbaceous material cycles rather quickly compared to woody debris or needle-cast (preventing a thick layer from forming). Shrub cover in open stands may reduce raindrop impact, but may offer less protection than grasses against overland flow beneath their canopy.

While plant and organic matter cover appeared more uniform in forested areas, surface rock fragments were more common in woodlands and shrublands. Surface rock fragments are capable

of reducing the impact of raindrops on the soil just as organic cover types can, and the presence of coarse fragments in the soil matrix can increase infiltration of water thereby reducing run-off and erosion. While woodlands and shrublands tended to lack a continuous cover of organic material, this fact might be made up for somewhat by the presence of rock. However, the presence of surface rock may itself be an indicator of natural levels of background erosion.

If there was no difference in slope, permeability or drainage between the soils on a woodland or shrubland site versus a Douglas-fir forest, it might be reasonable to expect that a greater amount of natural erosion would occur in the woodland or shrubland areas because vegetative and organic soil cover was not as continuous. Therefore, it may be expected that woodland and shrubland soils in the project area tend to be more exposed to raindrop impact or run-off. While the coarse fragment content of the soil may encourage downward movement of water, discontinuous surface rock may not be as effective of a barrier to overland water flow compared to a continuous cover of litter and duff. As a result of natural site variation, woodland and shrub vegetation may create more conducive conditions for run-off and erosion, inherently sustaining higher levels of both because of the type of vegetation that these sites support. A naturally higher rate of erosion and run-off on these sites may in turn explain the higher amount of surface rock found in some locations. Historic soil loss could have transported some sediment off-site over time, exposing the gravel and rock contained within the loamy matrix of the soil profile.

In assessing inherent erosion hazard ratings (EHR) 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 two-year, six 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 EHR ratings mean that accelerated erosion is likely to occur in most years and water quality impacts may occur. High to very high EHR ratings mean that effects to soil productivity and water quality are likely to occur when accelerated erosion happens. Approximately 9 percent of the ground proposed for treatment was listed by the soil survey as having potentially high EHR, approximately 61 percent of all proposed treatment acres had EHR estimated as moderate, and approximately 30 percent of the area within all treatment units was estimated as having low potential EHR. But existing EHR was considered low throughout the project area (100 percent) because of the abundance of soil surface cover in the form of rock, organic matter, and live vegetation.

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). Vegetative cover averaged 69 percent across the project area and cover from organic matter averaged 96 percent. Treatment units within the project area appear to be meeting forest plan standards governing soil cover and as a result active signs of erosion such as pedestalling,

terracettes, rills and gullies were rare to absent. No erosion hazards such as landslides were observed.

Soil Porosity

Thirty-nine percent of the acres in the project area have been rated by the soil survey as having a high average compaction risk. The remaining 61 percent of soils within the project area received moderate ratings. Average risk of compaction is the weighted average of all compaction ratings found within a particular soil family association or map unit. According to this rating system, a rating of low would generally be assigned to surfaces that are relatively impervious to compaction such as rock outcrops. However, this rating system may not accurately reflect actual compaction risk. Some soils, such as those with sandy or gravelly textures, could also have low compaction hazards because they are not only less sensitive to compaction than finer textured soils, but may even be positively influenced by reduced pore space and improved water holding capacity. Therefore, it is important to conduct site-specific investigations of soils in order to ground truth soil survey findings and evaluate whether or not significant compaction hazards actually exist.

In the Beaverslide 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. This compaction was primarily located on old skid trails. Very little compaction was observed on slopes greater than 35 percent. In many cases, soils on steeper slopes may be just as susceptible to compaction as those found on more gentle terrain, but the topography on those steeper slopes probably limited the mobility of machinery and did not lend itself to extensive use of ground-based logging equipment during past harvests. Of the acres proposed for logging under Alternatives 3, 4, and 5, approximately 27, 26 and 20 percent, respectively, had records of past forest management activity. Of that past management, up to two-thirds of the treated acres were treated using ground-based equipment. About one-quarter of the acres in the current proposed alternatives would be treated with ground-based logging systems, and out of those acres nearly one-third have records of receiving ground-based treatments in the past.

Where compaction was observed it was associated with old disturbance from past management activities, mostly associated with major skid trails. The greatest amount of detrimental compaction was observed on the soils with the least amount of gravel or rock fragments. Rocky ridgelines and alluvial flats composed of river-wash soils were relatively well armored by their rock content and exhibited little detrimental compaction.

Currently, two proposed treatment units (3 and 39) are at or exceed the forest plan standards for compaction in subsurface soil at the 4- to 8-inch depth. Another two units were considered to possibly be in danger of exceeding compaction standards due to cumulative effects caused by future management (42 and 85). Observed detrimental disturbance due to compaction was associated with old primary skid trails. Average areal extent of detrimental compaction observed within ground-based treatment units was about seven percent (within a general range of 0 to 15 percent with one outlier at approximately 28 percent). Detrimental compaction observed in

skyline, helicopter, and fuels units was uncommon enough that it does not likely have a measurable effect (mostly 0 percent or slightly above).

Soil Organic Matter

Soil cover from organic matter was nearly continuous throughout the project area except on some old skid trails and landings. Even where cover was naturally patchy, such as in woodland and shrub vegetation types, soil cover standards were met (well exceeding 50 percent as described above). Average observed depth of litter and duff was 2.39 inches with both components equaling approximately half of the total respectively. In addition to cover directly on the soil surface, most locations within the project area had a canopy cover of perennial, live vegetation, which serves as a relatively continuous source of replenishment for soil organic matter.

Currently, coarse woody debris (CWD) greater than 20 inches in diameter is relatively sparse throughout the entire project area. While some large coarse wood exists, average diameters are close to seven inches. As a result, CWD standards outlined in the LRMP are not likely being met in the project area at this time. Large diameter trees and snags were present; however, these size classes were under-represented on the forest floor in most surveyed units. It is not known whether this phenomenon is man-made and the result of past harvest, or the natural result of past fires or rapid decomposition.

Desired Condition

Significant change or impairment to the productive capacity, hydrologic function or environmental health of the soil should be avoided:

- In order to safeguard soil productivity soil cover should be sufficient to prevent the rate of accelerated soil erosion from exceeding the rate of soil formation, soil porosity 4 to 8 inches beneath the soil surface should be at least 90 percent of the total porosity found under undisturbed or natural conditions, and organic matter should be present in sufficient amounts to prevent significant short or long-term nutrient cycle deficits and to help avoid adverse physical soil characteristics.
- To preserve hydrologic function, soil permeability and infiltration rates should not be adversely impacted.
- Overall soil health should be considered such that soil reaction class, buffering or exchange capacities, or biological populations are not altered to the degree that significantly affects soil productivity, soil hydrologic function, or the health of humans and animals.

In order to meet these desired conditions, the Six Rivers National Forest LRMP includes soil quality standards that serve as thresholds for disturbance which, when exceeded, are meant to indicate potential declines of soil quality or possible departures from one or more of the desired conditions.

Currently, desired conditions for soil productivity are being met across the proposed treatment area with the exception of two units. Existing erosion hazard risk is low and areas

containing accelerated erosion or landslide hazards have not been observed in the treatment units; however, a number of road locations would require some reconstruction in order to remedy current instabilities and to prevent further off-site movement of soils (see Watershed Section). Areas exhibiting detrimental compaction do exist, but the extent of this past disturbance is relatively small and localized to old primary skid trails and landings. Most of the proposed treatment areas currently meet porosity standards and those that do not would be subject to special mitigations (see Chapter 2, page 20) that have been proposed to reduce the level of historic disturbance and prevent the incremental, cumulative addition of new detrimental disturbance. Soil cover standards are also currently being met, with the majority of the proposed treatment area exhibiting a continuous cover of litter, duff, and live vegetation. While coarse woody debris may not be as abundant within the size classes prescribed in the soil quality standards, it was observed throughout the project area within a range of decay classes. It is expected that large diameter CWD levels will continue to increase and make progress toward meeting standards as snags fall over and more are recruited as a result of natural tree mortality.

Hydrologic function of the soil resource also appears to be in satisfactory condition. Infiltration and permeability do not appear adversely affected as soil porosity is within standard throughout most of the project area. Where porosity standards are not currently being met, site remediation is expected to improve hydrologic function and reduce potentially adverse conditions. Soil cover also appears to exist in amounts adequate to slow current rates of runoff and encourage movement of water through the soil profile. Evidence of accelerated runoff and erosion such as pedestals, terracettes, rills, and gullies were uncommon or absent within treatment units.

Soil nutrient cycles also appear to be functioning sufficiently such that soil health does not appear impaired. Recruitment of coarse woody debris is ongoing as natural tree mortality occurs, snags are retained, and CWD eventually falls to the forest floor providing additional long-term substrate for forest organisms and the soil nutrient cycle. Organic cover (litter and duff) also appears in sufficient amounts to support the nutrient cycle. Plant life appears vigorous at this time.

Environmental Consequences

The potential effects of the proposed management activities on the soil resource were evaluated using the Region 5 Soil Quality Standards and the Six Rivers' LRMP standards and guidelines as evaluation criteria. The evaluation criteria specifically address soil cover, soil porosity, and soil organic matter. Indicators of soil quality were used to discuss potential effects resulting from the range of proposed management alternatives (Table 35). Management alternatives were compared to each other using their anticipated effects on soils as well as their ability to comply with applicable soil quality standards as the basis for comparison. This assessment is a qualitative estimator based on past experiences, observations and monitoring data.

Alternative 1 – No Action

Direct Effects and Indirect Effects

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 old 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.

Table 35. Comparison of soil quality indicators by management alternative

Environmental indicators	Alternative 1	Alternative 3	Alternative 4	Alternative 5
Ground–based treatment acres	0	607	593	619
Total miles of new temporary roads	0	5.3	0	5.3
Acres in new landings	0	2		0
Predicted ability to meet erosion standards/relative ranking	Meet/1	Meet/3	Meet/2	Meet/4
Predicted ability to meet porosity standards/relative ranking	Meet/1	Meet/3	Meet/2	Meet/4
Predicted ability to meet soil cover standards/relative ranking	Meet/1	Meet/3	Meet/2	Meet/4

In addition to skid trails, the existing infrastructure of roads and temporary roads would also remain in place. While new temporary roads would not be built and re-use of old roads would not occur, old roads that have failed would continue to erode due to poor design and construction, lack of maintenance, or improper/incomplete decommissioning. Although old road failures might not be numerous and may result in fewer disturbances than new road construction, they will likely continue to contribute a disproportionate amount of erosion and ultimately sediment as compared to the surrounding forest, thereby reducing offsite soil productivity.

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. CWD levels are also likely to continue to increase. As a result, erosion hazards would likely remain low and soil nutrient cycles would be maintained.

However, in the event of a wildfire adverse effects on soil cover could potentially be more severe in an untreated forest than in one of the management alternatives. It is speculated that intensive harvests can be preferable to wildfire in terms of soil nutrient balance. While coarse woody debris could increase due to the potentially large number of snags that could be left behind after a wildfire, it may be more likely that fire intensity and severity would increase in untreated stands, potentially consuming not only the litter and duff on the soil surface, but also the vegetation that is the source of that cover. Depending on the fire, soils could potentially be sterilized of nutrients or suffer from off-site movement of nutrients due to a lack of cover to prevent erosion. In either case, recovery of vegetation and re-establishment of soil cover after a wildfire could possibly be delayed causing a further loss of soil and disruption of the nutrient cycle.

Cumulative Effects and Summary

Not treating the project area could result in unknown effects on productivity in the future in the event of a wildfire. However, due to a lack of direct and indirect effects as a result of this alternative, no cumulative effects are anticipated at this time. Because of the lack of adverse effects, the Forest is likely to continue meeting, or make progress toward LRMP standards. By meeting soil quality standards, it is expected that desired conditions pertaining to the soil resource would be achieved.

Alternatives 3, 4, and 5

Direct Effects and Indirect Effects

Erosion - 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 clearcuts 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. Recent soil disturbance monitoring on the Klamath National

Forest 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. Machine 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.

Ground-based logging systems would be limited to slopes less than 35 percent in all alternatives. According to a recent study in a nearby project area on similar soils, 60 percent minimum residual soil cover was recommended to prevent significant erosion from occurring on slopes of this steepness and predominate texture (Table 36). However, if more than 40 percent of the soil surface was disturbed by ground-based logging systems, not all cover would be completely removed in the affected area. In fact, the disturbance would very likely create patches of exposed mineral soil totaling less than the threshold amount. Average existing soil cover supplied by organic material is approximately 96 percent, and average canopy cover provided by live vegetation is approximately 69 percent. The overlapping of ground and canopy cover effectively provides levels exceeding 100 percent in many places. Even if maximum expected disturbance levels resulted from any of the action alternatives, soil cover is not expected to fall below the suggested 60 percent. The areal extent of soil disturbance (on a per unit basis) created by ground-based logging operations that would occur as a result of the action alternatives is expected to fall within the range previously cited by Alexander and Poff (1985) (4 to 11 percent) due to consideration given to skid trail spacing and their reuse as outlined in the project design criteria. This estimate appears reasonably consistent with other relatively recent results observed within timber sale areas in Northwest California.

The use of skyline logging systems 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 ground-based systems, 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. Helicopter logging would be expected to cause even smaller amounts of soil disturbance than skyline operations, usually caused when cut trees hit the ground and cause a small depression to form in the surface soil. The level of estimated detrimental disturbance from past helicopter logging activities has been shown to average as much as 6 percent within a given unit.

While unit-level disturbance from helicopter logging is often minimal, this harvest method can require the construction of landings that may cause an additional loss of soil productivity. Out of 74 helicopter landings that may potentially be used in this project area, all but 4 already exist. Existing landings sometimes receive minor blading or small tree removal in order to prepare them for use. New landings would add approximately 0.5 acre of disturbance per landing, effectively

taking 2 additional acres out of production. Sediment control measures would be used to prevent sediment movement from landing sites during maintenance and construction; therefore, resulting erosion is expected to be minimal.

Skyline and helicopter logging would be used on slopes greater than 35 percent in order to reduce the potential amount of erosion on steeper slopes. Due to the terrain in these treatment units, additional cover is recommended as slopes increase in steepness (Table 36). Given the expected levels of disturbance resulting from skyline and helicopter logging systems, as well as the high amount of cover described for the project area above, soil cover is not expected to fall below the recommended minimum amounts.

Table 36. Minimum total soil cover needed for gravelly loam soils in treated stands to minimize soil erosion

Slope class	Minimum percent of soil cover
0-35%	60
36-59%	70
60-69%	80
>70%	90

Even under undisturbed conditions, erosion occurs at natural levels in the environment. Although minimum recommended levels of cover are expected to be maintained under each alternative, erosion may increase somewhat as a result of timber harvest activities. However, WEPP modeling indicates that this increase should be short-term for both commercial thinning and regeneration harvest units (Table 37). Immediately after disturbance, and during the first year following harvest, erosion is expected to reach its maximum amount. By year two, tons per acre of erosion should be in decline as the landscape revegetates. By year three, erosion should continue its decline and be close to background levels again.

Table 37. WEPP modeling results

Year	Average erosion (tons/acre)
Baseline CT	0.26
Year 0	0.78
Year 1	0.73
Year 2	0.45
Year 3	0.32
Baseline Regen.	0.40
Year 0	0.82
Year 1	0.78
Year 2	0.63
Year 3	0.52

All alternatives are expected to have very similar effects on erosion and not adversely affect the resource due to design criteria put in place to maintain soil productivity. But slight differences would be expected to occur between alternatives if each was implemented. Alternative 5 is expected to have the highest likelihood of producing the most disturbance that could potentially affect erosion due to it having the most acres of ground-based treatment. Alternative 3 would likely have the second highest effect on erosion even though it proposes to treat the smallest area because it has more ground-based treatment acreage that Alternative 4. Alternative 4 would likely have the least effect on erosion because it has the least ground-based acreage and the most helicopter units out of all of the alternatives.

Fuel treatments are likely to have a minimal effect on erosion within the project area. Piling, burn piles, and jackpot burning are expected to maintain sufficient soil cover. It is anticipated that 25 percent of the treatment unit acres would receive follow-up treatments to reduce fuel loading from stem breakage and delimbing during tree-falling and bucking activities, as well as natural fuel concentrations. Treatments of activity fuels would vary by logging system and proximity to private land (see Chapter 2, Table 1). Lop and scatter with machine grapple piling would be used as a follow-up treatment as needed on ground-based units in areas of heavy stem breakage and/or natural fuels concentrations (machine piling is anticipated to occur on up to 152, 155, and 155 acres in Alternatives 3, 4, and 5, respectively). Lop and scatter with jackpot burning would be the follow-up method on skyline units, while on helicopter units, different combinations of lop and scatter, hand piling (127, 133, and 127 acres in Alternatives 3, 4, and 5, respectively), and jackpot burning would be used. While machine piling presents the greatest possibility for disturbance when compared to hand piling, the use of machine piling on gentler slopes and hand piling on steeper slopes would minimize potential for site disturbance. Burning of piled and concentrated fuels should meet the required soil cover amount since burning would be highly localized and not broadcast. The same effect is anticipated for all alternatives because of the similarities in acreage and treatments.

All alternatives are expected to have a beneficial effect regarding road decommissioning that would reduce ongoing erosion problems due to deteriorated roads. Road maintenance would maintain existing roads that are currently drivable including existing temporary roads. This could include blading and shaping of the road surface, ditch cleaning and clearing of encroaching vegetation along the roadway. This work involves disturbance of soil material within the road prism and is not expected to affect soils off of the prism.

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 criteria 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 the roads are decommissioned, the effect is expected to diminish and fade as the site revegetates. Alternative 4 is the least likely to increase erosion as a result of road activities because no new temporary roads would be built and the fewest amount of existing roads would be used. Alternatives 3 and 5 would be expected to have a greater effect than

Alternative 4 because these alternatives include temporary road construction, but they would have the same effect as each other because their road proposals are the same.

System road maintenance, improvement, and decommissioning would also occur under each alternative. These actions would help prevent the formation of future problems that could contribute to the off-site movement of soil. In addition, these activities would fix current road issues identified in the watershed section, thereby reducing the contribution of sediment created by the road systems. The effect of each alternative would be expected to be the same because the proposals are the same (see Table 1 in Chapter 2).

Soil Porosity - Hill and mountain slope soils tend to be deeper, loamy, and of good tilth whereas riverwash soils at the base of hills and shallow-soiled, rocky ridgelines are especially well-armored against compaction due their gravel, cobble, and boulder content. Although the presence of gravel in the surface and subsurface soil horizons is common throughout the project area and can sometimes armor the soil against compaction, loam-textured soils tend to have very well balanced drainage and water-holding capacity for growth and are susceptible to the detrimental effects of compaction. Surveys of the Beaverslide project area revealed that most of the existing disturbance (0 to 15 percent areal extent depending on location) found within the project area was associated with compaction—almost exclusively a result of old skid trails. This disturbance averaged 7 percent across ground-based logging system units. Based on these observations, the soils within the project area have risk for compaction.

Skidding equipment can increase the soil's bulk density and reduce soil porosity. A 10 percent reduction in soil porosity across 15 percent of a given unit area is the threshold used to determine significant impairment of soil productivity. Alexander and Poff (1985) reported that while commercial thinning with tractor and rubber-tired skidders visibly disturbed 34 percent of a given area, only an average of 18 percent was compacted within the same areas, indicating that while soil disturbance due to logging operations may occupy a rather large surface area, the extent of compaction accounted for a significantly smaller portion of that disturbance. Additionally the authors noted that when skid trail layout was considered, disturbance could be as low as 4 to 11 percent. Recent soil compaction and disturbance monitoring on the Happy Camp District, Klamath National Forest of conventional tractor logging with rubber-tired skidders showed that 11.5 percent of the monitored unit was in main skid trails and landings where detrimental compaction was found. Small increases in compaction also occurred in other areas where machinery made one or two passes but this increased compaction did not exceed threshold values. The Iron Canyon study, conducted by PSW and the Shasta-Trinity National Forest, looked at compaction resulting from similar operations on a high compaction risk soil in August (dry conditions); this study found that disturbance increased from 33 percent (legacy) to 78 percent cumulatively, but only seven percent of this area had detrimental compaction where total porosity decreased more than 10 percent.

Feller-bunchers and rubber-tired skidders are planned for harvesting timber across several hundred acres in each alternative. Feller-bunchers have lower ground pressures than the skidders,

though turning and repeated travel may result in compaction nonetheless. These systems are thought to be lighter on soil though results depend on the restriction of travel. With proper layout of the skid trail system (which maximizes the reuse of existing skid trails), detrimental disturbance can be kept within allowable limits. Placing a high priority on reusing existing skid trails and designating main skid trails and landings would ensure that detrimental effects can be minimized and would be consistent with the literature.

Currently two units exceed and two units are relatively close to compaction thresholds. Remediation of compaction with subsoiling could potentially reduce existing disturbance by treating landings and high-traffic areas where skid trails enter the landings. While subsoiling is not expected to be entirely effective in alleviating compaction in 100 percent of places treated, when applied properly it should be effective in most places treated, and adequate to meet the intent of the soil standards. Proper application depends upon equipment used (true winged subsoiler, not a modified rock ripper), proper soil moisture when treated to provide good soil tilth, and done in conjunction with effective erosion control measures. Other effects of subsoiling, such as damaging living roots and exacerbating root disease have not been shown to be significant factors in considering overall effects and benefits.

The risk of a loss of soil porosity is fairly equal for all alternatives given the small differences in ground-based treatment acres. Alternative 5 has the most potential for the creation of compaction, followed by Alternative 3, and Alternative 4. The potential for compaction is directly related to the proposed number of ground-based treatment acres. Other proposed treatments (skyline, helicopter, and fuels) are not anticipated to have significant adverse effects on soil porosity. While unit-level disturbance from helicopter logging is often minimal, this harvest method can require the construction of landings that may cause an additional loss of soil productivity. Out of 74 helicopter landings that may potentially be used in this project area, all but 4 already exist. Existing landings sometimes receive minor blading or small tree removal in order to prepare them for use. New landings would add approximately 0.5 acre of disturbance per landing, effectively taking 2 additional acres out of production.

Temporary road construction also has the potential to reduce the productive capacity of soils even for some time after they have been decommissioned. Road construction as well as the volume of traffic traveling these roads can reduce the porosity of the soil and adversely affect growing conditions on the site. Because no new temporary roads would be built in Alternative 4, it would have the least effects from road construction of any kind. Alternatives 3 and 5 would be expected to have a greater effect than Alternative 4 because these alternatives include temporary road construction, and they would have equal effects because their road proposals are the same (see Table 1 in Chapter 2, and the Watershed Report for further discussion of temporary roads).

Despite the potential for soil compaction related to ground-based logging in the treatment units, it is expected that porosity standards would be met under each alternative because of the relatively low occurrence of existing compaction across the project area and the application of mitigation measures where compaction does occur. Looking at the results of various studies conducted in the pacific southwest region, it is expected that detrimental disturbance from

compaction would occupy less than the maximum allowable threshold for areal extent on a per-unit basis (15 percent). By emphasizing the reuse of skid trails, significant new detrimental disturbance can be avoided. Where the potential exists for legacy disturbance and new disturbance to exceed standards, subsoiling would be used to treat high-traffic areas and reduce disturbance to acceptable levels. Units where subsoiling needs are anticipated are specified in the project design criteria.

Organic Material - Organic matter should be maintained in amounts sufficient to prevent significant short- or long-term nutrient cycle deficits, and to avoid detrimental physical and biological soil conditions. Proposed mechanical and fuels-related treatments in each proposed alternative have the potential to decrease organic cover along skidding and yarding routes, and where burning and other fuel treatments occur. But the minimum 50 percent organic cover standard is fully expected to be maintained (see the Erosion section above for a discussion of soil cover). Ground-based mechanical harvesting would cause a small loss of nutrients in the skid trails due to soil displacement and potential skid-trail erosion. But most of this loss would move only a short distance and would still be retained on site because soil cover standards are expected to be met.

Skyline logging could result in a smaller loss of nutrients and soil organic matter than ground-based logging, but this is not expected to measurably reduce soil productivity on an acre basis due to the limited disturbance of ground cover it would cause. Helicopter yarding would cause a very slight amount of erosion and loss of nutrients where the trees fall or if trees slide down slope, but the anticipated effect on soil cover would likely be less than that of skyline logging; therefore, no significant off-site transport of organic matter or nutrients is expected. Post-harvest fuel treatments could also impact organic groundcover during coarse slash removal due to piling of nutrient rich organic materials and a small amount of topsoil that may inadvertently end up in the pile. It is anticipated that 25 percent of the treatment unit acres would receive follow-up treatments to deal with fuel loading from stem breakage and delimbing during tree falling and bucking, as well as natural fuel concentrations. Treatments of activity fuels would vary by logging system and proximity to private land (see Chapter 2, Table 1). Lop and scatter with machine grapple piling would be used as a follow-up treatment as needed on ground-based units in areas of heavy stem breakage and/or natural fuels concentrations (machine piling is anticipated to occur on up to152, 155, and 155 acres in Alternatives 3, 4, and 5, respectively). Lop and scatter with jackpot burning would be the follow-up method on skyline units, while on helicopter units, different combinations of lop and scatter, hand piling (127, 133, and 127 acres in Alternatives 3, 4, and 5, respectively), and jackpot burning would be used. This disturbance may have a short-term negative impact on soil fertility in very small patches throughout the treated area, but the effect of these activities is expected to be minimal and not reduce organic cover levels below standard.

Jackpot and pile burning could result in a loss of nitrogen but would also cause nutrient leaching into the soil from the ash. Soil beneath the piles may lose some nutrients and experience

changes in the biological components of the surface soil due to elevated soil temperatures. But the nutrient loss from the burned pile area would be short-term as cover reestablishes and is not expected to have a significant effect on soil productivity.

There is a general agreement of researchers that multiple bole only harvests would not deplete the soil of nutrients; however, multiple short-term (50 to 60 years) whole tree or biomass harvests have the potential to remove nutrients at a rate that has a high probability of leading to soil productivity decline within a few tree rotations. The effect would be more pronounced on soils with low site potential compared to soils with high site potential (such as some of the major timber producing soils found in the project area). Biomass removal, using long rotations (80 to 100+ years) would have much smaller impact to nitrogen removal compared to total biomass removal with short rotations as reported in the literature.

A thinning biomass removal instead of 100 percent removal, as previously discussed, reduces the negative effects and increases the ability of natural nutrient accumulation and cycling to offset nutrient losses. In the short-term, Powers et al. (2005) reported no negative soil productivity decline with whole tree harvest. Powers et al. also showed that even complete biomass removal followed by reforestation had no general effect on the standing biomass of a 10-year-old plantation. Additionally, Wells and Jorgensen (1979) speculated that if biomass harvest is substituted for prescribed fire, overall nutrient removal may be unaffected. If biomass harvest prevents a serious wildfire, the nitrogen balance may even be in favor of biomass harvest. The planned harvest prescriptions (commercial thin and regeneration/reforestation) proposed for the management alternatives are not expected to lead to soil productivity declines, which would be consistent with the findings in the literature discussed above.

Retention of coarse wood totaling at least five logs/acre (20-inch diameter and 10-foot length) is desirable per LRMP direction. Coarse wood does not necessarily increase soil fertility substantially since the material is more resistant to decay with high carbon to nitrogen ratios. However, coarse wood can increase soil moisture and moderate temperature flux by providing microsites for increased biologic activity. These coarse wood microsites can improve soil recovery and supplement soil function. Retaining existing coarse wood levels and allowing for recruitment through the natural addition of snags and or standing trees would facilitate these benefits.

Levels of coarse wood within the desirable size classes are lacking throughout the project; however, forest stands are generally being silviculturally managed to grow larger trees, so CWD is expected to eventually come into standard. Existing coarse woody debris would be retained in the treatment units and snag retention guidelines would also protect the future supply of CWD under all management alternatives. CWD would increase over time by occasional natural falling of standing trees and snags would help to maintain long-term soil productivity. It is anticipated that sufficient overstory trees would remain to supply additional CWD in the long term.

Cumulative Effects

The analysis area for cumulative effects on soils is defined by the treatment area. Lands within the project area that has a potential to have cumulative effects on the soil resource are those areas that were subjected to past vegetation management activities, such as logging, site preparation fuels treatments, and natural fires. Cumulatively, ground-based harvesting, machine piling and biomass removal have the most potential to affect soil productivity because these activities are mostly associated with reductions in soil porosity (compaction), soil and cover displacement and nutrient removal, all of which have the ability to recover over the long term. There may be a slight (within normal variability) short-term soil productivity decrease but long-term soil productivity would not be significantly decreased from the proposed management activities. A few of the units in this project may currently exceed or come close to the 15 percent detrimental disturbance threshold, but implementation of any of the action alternatives is not expected to have an adverse affect on soils due to a combination of design criteria that focus on treatment 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.

To address the cumulative effects, a conservative approach was taken to maintain or reduce existing levels of disturbance. Reuse of old skid trails and avoidance of reentry into areas of concern should serve the project goals of avoiding new detrimental disturbance and adverse cumulative effects. Reclamation would focus on major trails and landings, especially in units with high amounts of old harvest routes that have resulted in relatively high levels of compaction. Less-traveled trails are excluded since they are not expected to have detrimental levels of compaction, and subsoiling can have positive and potentially negative effects. Where compaction is extreme, subsoiling should be an effective practice to relieve most of the compaction. Recommended subsoiling would be 12 to 18 inches deep and only occur on high-traffic skid trails and on landings, where the great majority of detrimental compaction occurs. While subsoiling can increase soil porosity, this effect can diminish with time as soil settles. Visits to previously subsoiled locations on the Forest revealed the importance of reestablishing vegetation on reclaimed sites in order to help prevent resealing of the soil surface. Where skid trails would be subsoiled, there should be an adequate overstory that would encourage trees to seed in following harvest. Where only low to moderate compaction exists, leaving soils intact is more desirable. The net effect is that the proposed management alternatives should not introduce any meaningful degree of new compaction such that soil productivity is significantly reduced.

Overall, the intensity of harvesting and fuel reduction activities would minimize any cumulative effects on soil cover or nutrient cycling. The use of existing skid trails and landings minimizes cumulative effects to these previously disturbed acres. As a result, cover and organic matter standards are expected to be met. Design criteria and natural processes should also address current shortfalls in CWD within the project area by moving management in a direction that would allow attainment of the standard in the future. The dynamic and highly variable nature of soil ecosystem processes and its strong buffering capacity minimize the risk of having measurable, negative, or long-term cumulative effects on soil productivity.

The area has a high level of productivity and recovery potential if soils are left intact. The indications are that the site has a very high growth potential based on the field observations. The site potential, together with other soil indicators being met, leads to the conclusion that the sites have a very high resiliency to soil disturbance, and it is not expected that soil productivity would be adversely affected.

Watershed Resources

The analysis area for direct and indirect effects is the 13,241-acre project area. For cumulative effects the analysis is the 6th-field watersheds containing treatment acres within the project area. The majority of the project area is in the Upper and Lower Tributaries Upper Mad River watersheds.

Affected Environment

The Beaverslide project area is within the Upper Mad River 5th-field HUC. Two 6th-field watersheds, Lower Tributaries Upper Mad River and the Upper Tributaries Upper Mad River include the majority of the project area (99.7 percent). Less than 27 acres are within the Headwaters North Fork Eel River where the Beaverslide project boundary follows the road just across the watershed boundary (Table 38). There are 2.6 acres across the watershed boundary in the Ruth Reservoir watershed. These small treatment acres are high in the watershed at the watershed boundaries and contain no stream channels. Due to the small amount of treatment in the Ruth Reservoir and the lack of treatments in the Upper North Fork Eel River, these watersheds will not be analyzed further.

Table 38. Watershed and project acres and percent watersheds within project area

HUC 6 name	Watershed acres	Project area acres in watershed	Percent watershed in project area
Lower Tributaries Upper Mad River	27,897	11,847.6	42.5
Headwaters North Fork Eel River	32,982	26.6	0.08
Upper Tributaries Upper Mad River	28,987	1,362.9	4.7
Ruth Reservoir	20,250	2.6	0.01
Upper North Fork Eel River	22,005	0.5 (no treatment acres)	0.002
Project Area Acres		13,240	

HUC – hydrologic unit code

Existing Condition

The existing condition relies heavily on the Mad River Watershed analysis, the Mad River TMDL, and field work in the summer and fall of 2007 and 2008. The climate is typical for the north coast of California with hot, dry summers and cool wet winters. The average annual precipitation for the watershed is 60 inches (USDA Forest Service 1998). The elevation within

the project area ranges from a high of 4,744 feet to a low of 2,720 feet. The hydrology is rain dominated at 3,000 feet and primarily snow dominated above 4,000 feet.

Geology

The watershed is primarily underlain by rocks of the Franciscan Assemblage (USDA Forest Service 1998). Dominant rock types found in the watershed include metagraywacke, mélange, Yolla Bolly greywacke and South Fork Mountain schist and semi-schist. Within the project area, metagraywacke is the most common rock type. There is little identified melange terrain within the project area and only a small amount of unit K7 that contains some blue schist (Table 39).

- Metagraywacke: This geologic unit tends to form steep and incised topography with sharp ridge crests that is generally stable, with scattered shallow slides and relatively few older deep-seated slides.
- Mélange: This unit is minor within the project area. The topography tends to be gentle and hummocky, with broad ridges. Deep-seated landslides, especially earth flows, are the most common areas of mass movement with scattered debris slides in toe zones.

Channels on schist or semischist are prone to debris slides. Where channels occur in melange terrain, they are prone to slumping, earthflows, gullying and headcutting (ibid).

Table 39. Map units within the project area

Map unit	Formation or rock type	Mass movement type description	Acres
K11A	Argillite-matrix melange - very weak	Melange most prone to mass movement	33
K3	Metagreywacke	Shallow debris slides metagraywacke	8,104
K3c	Chert or metachert	Shallow debris slides metagraywacke	95
K4	Yolla Bolly undivided; mostly metagraywacke; conglomerate, chert, argillite	Shallow debris slides metagraywacke	1,927
K5A	Yolla Bolly broken formation	Yolla Bolly broken formation	3,037
K7	Undivided; mel to broken formation; gs + ch + blueschist + um	Melange most prone to mass movement	46
Total Acres			13,240

An active landslide coverage for Beaverslide produced from aerial photographs was used for a preliminary look at unstable areas in the project area. Of the 33 active slides, the majority consist of shallow debris slides (Table 40). Of the four active landslides within harvest units in the GIS coverage; two are on roads, one is on a road within an older harvest unit, and one is natural. The proposed treatment units were then field-checked for unstable landforms. Of the additional unstable areas identified on the ground, the majority of unstable areas are gullies or

shallow debris flows associated with channels and are part of the riparian reserves. All areas of instability were identified and excluded from the harvest unit design of the action alternatives.

Table 40. Active landslides identified from aerial photography

Type	Harvest	Natural	Road	Road in harvest unit	Total
Avalanche Chute				1	1
Gully			1		1
Rock Slide		1			1
Shallow Debris Slide	12	9	5	4	30
Grand Total	12	10	6	5	33

Hydrology

The Upper Mad River watershed is defined from the headwaters of the Mad River to Matthews Dam on Ruth Reservoir. The main stem is generally not incised and flows on a relatively gentle gradient through a wide floodplain. Stream flow in the Mad River above Ruth Reservoir is intermittent, with subsurface flow being the standard in many reaches during the summer months. Many of the smaller tributaries that flow into the river have steep gradients with well-defined inner gorges. Deep Hollow and Lynch Creek to the north are perennial fish-bearing streams. Smith Creek, Armstrong Creek, Van Horn Creek, and Secret Gulch are intermittent fish-bearing channels. South Fork Mad River is the southern boundary of the project area and is a perennial and fish-bearing stream. There are flowing springs that intersect channels and add to surface flow for several hundred feet before going subsurface again. In some areas, road cuts have intercepted shallow groundwater and created springs along roads.

Riparian vegetation such as alder and willows are rare along the streams in the project area. Most of the intermittent and perennial channels are dominated by upland vegetation. Poison oak is a riparian species in this area and is thick in many of the drainages and swales in the project area.

The majority of stream channels are small first- and second-order headwater streams. Many of these channels are ephemeral and only have flow for short periods during the rainy season. Limited flow and high surface roughness due to obstructions such as logs and branches lead to quantities of sediment stored in the channels (Benda et al. 2005). When a large event occurs episodically, the sediment is moved downstream. Generally, only the perennial or fish-bearing channels have gravel to cobble substrate. The Mad River and South Fork Mad River have some reaches dominated by bedrock.

Water Flows

Discharge at the USGS gauging station above Ruth Reservoir range from a low mean of less than one cubic foot per second (cfs) for September to a mean of 646 cfs in February (http://ca.water.usgs.gov/archive/waterdata/99/11480390.html). The highest daily mean was

10,300 cfs in January 1997. The mean annual for water years 1980-1999 is 238 cfs. Most of the high flows occur between December and April.

Beneficial Uses and 303d Listing

Domestic and industrial water supply and resident trout habitat are the primary beneficial uses of water in the Upper Mad River. Due to the dam, there is no anadromous fish habitat above the Mathews Dam on Ruth Reservoir. Ruth Reservoir, the water supply source for the Humboldt Bay Municipal Water District, also provides recreational fishing and boating.

In accordance with Section 303(d), the State of California periodically identifies “those waters within its boundaries for which the effluent limitations... are not stringent enough to implement any water quality standard applicable to such waters.” In 1992, EPA added the Mad River to California’s 303(d) impaired water list due to elevated sedimentation/siltation and turbidity, as part of listing the entire Mad River basin. The North Coast Regional Water Quality Control Board (Regional Board) has continued to identify the Mad River as impaired in subsequent listing cycles, the latest in 2006. The 2006 303(d) listing identifies temperature as an additional impairment to the watershed. The EPA finished the Mad River TMDL for sediment and turbidity in December 2007. The temperature TMDL will be developed by the State of California in the future. In the Mad River basin, turbidity levels are closely linked with suspended sediment load. Thus, the TMDL focuses on total sediment load as well as suspended sediment load, which are the pollutants associated with excess sediment and turbidity that violate water quality standards.

Sediment Sources

Calculations of sedimentation at Ruth Reservoir show low rates of sedimentation in the Upper Mad River watershed. (Winzler & Kelly 1975, cited in DWR 1982) noted rates of 0.3 to 0.6 inches/year within the reservoir.

However, the 2007 Mad River TMDL estimates elevated sediment movement from management in the watershed. The Mad River TMDL breaks the watershed into subareas and calculates sediment production in these subareas from different sources. The lowest sediment delivery rates for the Mad River watershed are in the Upper Mad River watershed above Ruth Reservoir. For the entire Mad River, the upper watershed subarea, totaling 84 mi^2, produces 6 percent of the total sediment, the middle watershed (266 mi^2) produces 75 percent, and the lower watershed (130 mi^2) produces 19 percent. The EPA analysis showed 62 percent of sediment production basinwide was from roads, two percent was from timber sales and 36 percent was from natural causes, primarily the Franciscan mélange terrain and schist terrain (U.S. EPA 2007). The Mad River TMDL calculates needed reductions in total and suspended sediment are 26 percent for the Upper Mad subarea (comparable to the Upper Mad 5th-field watershed; ibid). Within the project area, the drainage showing the highest percent of management related sediment sources was Armstrong Creek at 66 percent (ibid).

Many factors may be contributing to the high sediment loadings, including timber harvest and roads. National Marine Fisheries Service (NMFS 2004) indicates that timber harvesting, road

construction, and other related activities have increased fine sediment movement, which can then be delivered to streams by overland flow. In addition, deep-seated landslides are present (particularly in the upper portions of the watershed) and contribute large sediment loads to the mainstem and tributaries (NMFS 2004). Road-related erosion still comprises the bulk of the management-related erosion: 62 percent of sediment production in the Upper Mad subarea is associated with roads, and only 2 percent of sediment production is associated with timber harvest, while 36 percent is thought to be associated with natural causes, primarily associated with unstable Franciscan, mélange, and schist terrain.

The Upper Mad subarea (comparable to the Upper Mad River 5th-field watershed) produces only 6 percent of the sediment within the larger Mad River watershed. For the Upper Mad River watershed, the total sediment is estimated at 234 tons/mi^2/year with 38 percent being from management-related sources. The TMDL target for sediment in the Upper Mad subarea was set at 173 tons/mi^2/year. This would mean a reduction of 26 percent for the Upper Mad watershed. EPA specified that in order to meet a 26 percent reduction in total sediment within the Upper Mad watershed, management-related sediment must be reduced by 68 percent over time. Activities within the proposed project are designed to reduce, minimize, and move towards meeting the EPA sediment load allocation.

Table 41. Sediment sources and percent of totals for the Beaverslide project area

TMDL hydrologic unit name	Percent road-related landslide	Percent road surface erosion	Percent harvest-related sources	Background sediment sources (landslide, creep, bank erosion as percent of total)	Management-related sources as percent of total	Total tons per square mile per year
South Fork Mad River	0	14.6	0	85	15	127
Armstrong Creek	45.5	18.3	2.4	34	66	506
Deep Hollow West	0	41.8	0	58	42	327
Barry Creek	0	21.4	0	78	22	208

Riparian Reserves

Desired Condition

Water temperature, sediment loads, and nutrient cycling will be at levels that provide for productive riparian and aquatic ecosystems. Instream flows and fluvial processes will occur at the rates under which the stream system evolved. Habitat diversity, channel stability, and water quality will be high. Water table elevation in wet meadows will be at or near pre-grazing levels and will provide for the needs of aquatic and riparian biota. Large woody debris recruitment rates will be sufficient to maintain suitable stream habitat conditions. Riparian vegetation and nearby lower slope terrestrial plant communities will have a diverse multi-storied structure and provide shade and maintain microclimate in the reserve corridor. In some drainages, reserve corridors will

extend to ridgeline saddles and connect with the corridors of other watersheds to provide for travel and dispersal of animals and maintain habitat connectivity across the landscape (LRMP p. IV-45).

Existing Condition

The riparian reserve stands to be treated are generally early to mid mature stands. They are very similar to the upland portions of the stands. They tend be dense single layer stands with a closed canopy. The relative densities are significantly higher than desired, leading to slower growth and increase the hazard of stand-replacing fires. Table 42 gives the seral stage and acres to be treated with riparian reserves. See the silviculture section for more details.

Table 42. Riparian reserve stands to be treated

Harvest units		Fuel treatment units		Fuel treatment corridor	
Unit seral stage	Acres	Unit seral stage	Acres	Unit seral stage	Acres
				EA	13.92
EA	23.9			EB	7.00
EA-MA	7.4	EA	20.8	EH	16.67
EA-MM	6.2	EB	1.1	EM	189.23
EH	17.6	EM	270.1	GF	8.93
EH, MM	41.8	GF	31.4	LK	6.07
EM	173.9	LM	65.0	LM	43.63
EM, MM	23.6	MA	32.1	MA	20.99
EM-MH	3.5	MH	7.3	MH	16.35
EM-MM	131.2	MM	142.2	MM	66.11
MA	94.0	PA	90.9	OG	0.18
MH	2.4	PH	0.1	PA	1.50
MM	68.7	PN	64.3	PH	16.55
MM,EH	11.3	SA	11.8	PN	11.60
MM,EM	2.5	SB	0.2	SH	29.14
PH	7.7	SH	5.6	SN	12.69
PH-EH	1.7	SN	89.4	ST	5.10
Total	617.3	Total	832.0	Total	465.69

SB shrub / forb harvest with predominant trees
SA shrub / sapling natural with predominant trees
SH shrub plantation
SN shrub natural
PH pole past harvest
PN pole natural (natural stand, no harvest)
PA pole natural with predominant trees
EM early mature
EH early mature past select harvest
EA early mature natural with predominant trees
EB early mature harvest with predominant trees
MM mid-mature
MH mid-mature past selection harvest
MA mid mature natural with predominant trees
LM late- mature natural (natural stand, no harvest)
OG old growth
GF grass/forb
LK lake
ST stream / river

Environmental Consequences

The issue relevant to this report is the effect of the project on water quality within the project area. Timber harvest and fuel reduction treatments, including maintaining and building roads

could deliver sediment to streams, thereby degrading water quality for downstream domestic users and impact fisheries resources and other beneficial uses. Measurement indicators are displayed in Table 43.

Methodology

Proposed harvest units were surveyed in July 2008. Stream channels and unstable areas were evaluated and flagged and, where possible, marked using GPS. Roads and culverts were evaluated for function and stream connectivity. Geographic information system (GIS) layers were used to calculate treatment acres and miles of road. The WEPP model was used to analyze erosion from project implementation and sediment movement to channels. This model has an error of plus or minus 50 percent. It is used to compare effects from different types of treatments. The Equivalent Roaded Acres (ERA) model was used for cumulative effect analysis.

Table 43 Watershed condition and water quality indicators

Watershed indicators	Alternative 1	Alternative 3	Alternative 4	Alternative 5
Acres of thinning within Riparian Reserves (RR)	0	529	618	618
Acres of fuels treatments within RR	0	1,915	1,915	1,915
Total Miles New Temporary Road	0	5.3	0	5.3
Mile of new temporary roads in RR	0	0.9		0.9
Miles of system road decommissioned	0	7.39	7.39	7.39
Miles of nonsystem road decommissioned	0	1.09	1.58	1.09
Miles of nonsystem road used as temporary roads and decommissioned	0	2.94	1.71	2.94
Miles of Roads decommissioned in RR	0	4.4	4.4	4.4
Miles of Roads upgraded to address water quality concerns	0	6.73	6.73	6.73
Number of stream crossings removed associate with decommissioning system roads*	0	30	30	30
Number of crossing removed associated with existing temporary roads	0	6	1	6
Number of crossings removed from nonsystem roads not used for temporary roads	0	0	5	0
Number of temporary ephemeral stream crossings	0	2	0	2
Cubic Yards		7,457	7,457	7,457

*27 culverts + 3 low water crossings

Spatial and Temporal Context for Effects Analysis

The direct and indirect effects analysis is based on the units within the project area. The cumulative effects analysis is based on 6th-field watersheds. Short-term effects are effects that occur within 5 years of the activity. Long-term effects are effects that occur more than 5 years after the activity takes place.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

According to the Upper Mad River Watershed Analysis, approximately 21 percent of the Upper Mad River Watershed has had timber harvest, with less than 15 percent being clearcut. Harvest data for the project area shows that approximately 2,033 acres, or 17 percent, has been regenerated by clearcut, shelterwood, seed tree, and overstory removal methods. Approximately 1,044 acres, or 9 percent, has had partial cutting by thinning, individual tree selection, and sanitation/salvage methods.

The most recent Forest Service project is the ongoing Little Doe/Low Gulch timber sale to the south of the Beaverslide project area. Kelsey Peak is a timber sale being planned to the east of the project area. An ongoing travel management project for ATV use is occurring concurrent with the Beaverslide Project. Additional details can be found in the silviculture report associated with this project.

Alternative 1 – No Action

Direct and Indirect Effects

The no action alternative is the continuation of existing condition. There would be no harvest, fuel reduction, or road decommissioning. With no additional management-related disturbance, there would be no additional impact to flows or water quality. Present impacts on water quality include roads contributing sediment to streams (discussed in the existing condition section above) and impacts from cattle. No management-related land disturbance would occur so there would be no additional sources of sediment. In the event of a large wildfire, water quality would be detrimentally affected by removal of vegetation; the main impact would be increased sedimentation and possibly increased temperatures until vegetation was reestablished. The TMDL for the Mad River watershed listed roads as the highest impact to water quality from management within the watershed

Alternative 3

Direct and Indirect Effects

Water Flows

For rain-dominated areas, changes in peak flow can only be detected where 29 percent of the area is harvested (Grant et al. 2008). For areas where rain-on-snow events can occur, the detection level for peak flow increases is 19 percent including harvest and area in roads (ibid). The magnitude of observed changes in peak flows from management activities diminished with increased watershed area (ibid). Under this alternative, 16.4 percent of the project are would be thinned and 1.6 percent would be regeneration harvested. Given that the regeneration harvest occurs in scattered units and most of the treatments are a moderate thinning, it is unlikely that changes in peak flow would be observed.

Water Quality

Temperature and elevated sedimentation are common water quality problems in forested areas of the west. Solar radiation is the most important source of radiant energy affecting stream temperatures. Shading of the stream has a large positive effect on temperature.

Commercial thinning of stands in the outer portion of riparian reserves (529 acres) would be beneficial to the riparian reserve in that the objectives are to increase the average diameter of the stand, and accelerate the development of the shade-tolerant understory. Accelerating the diameter growth of riparian stands would assist in creation of late-successional conditions sooner and provide for a faster development of large woody material sources for instream and terrestrial habitat. Another benefit would be to reduce the potential "wicking effect" of untreated riparian reserves in contributing to growth of large fires, as well as potential effects from moderate to severe burning on soil structure and erosion.

As the climate in the Beaverslide area is similar to the climate in western Oregon, the effect that this project would have on stream shade was estimated using the model described in the "Northwest Forest Plan Temperature TMDL Implementation Strategies" (USDA Forest Service and USDI Bureau of Land Management 2005) commonly used to calculate widths providing adequate shade for riparian buffers in western Oregon. The model provides the process for calculating the width of the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading (between 1,000 and 1,400 hours), known as the primary shade zone (Table 44). It also provides the process for calculating the width of the riparian area that provides shade in the morning and afternoon (0600-1000 hours; 1400-1800 hours), considered to be the secondary shade zone. In over-dense riparian areas, optimum shade can be provided by the primary shade zone alone, and the secondary shade zone may contribute little to shade since trees in the primary shade zone are already blocking the sun's solar radiation (USDA Forest Service and USDI Bureau of Land Management 2005).

The TMDL document suggests that thinning in riparian reserves should be considered as long as they meet the following conditions:

1. Vegetation density is high and would benefit from thinning.
2. Vegetation thinning would not occur in the primary shade zone. Vegetation thinning in the secondary shade zone would not result in less than 50 percent canopy closure post harvest.
3. Northwest Forest Plan standards and guidelines and BMPs still apply.
4. The width of the primary shade zone would be set using the values below, unless a shade model is used for site-specific analysis.

Table 44. Minimum width of primary shade zone (feet) based on slope and tree height

Tree height	Hill slope percent		
	<30	30 to 60	>60
< 20 feet	12	14	15
20 to 60 feet	28	33	55
>60 to 100 feet	50	55	60

From USDA Forest Service and USDI Bureau of Land Management 2005

A study of thinning treatments and the effects on stream temperature showed that thinning primary and secondary shade zones along 6 miles of stream led to a 4 degree (F) increase in temperature (USDA Forest Service and USDI Bureau of Land Management 2005). Thinning only the secondary zone gave no measurable increase in stream temperature (ibid).

The no-cut buffer for stream channels in the Beaverslide project area was set at 80 feet for non-fish-bearing and 160 feet for fish-bearing streams. Thinning to 60 percent canopy closure would be allowed from 80 to 170 feet from the non-fish-bearing stream and from 160 to 320 for fish-bearing streams. This is larger than the 60-foot primary shade zone shown in Table 44 above. To encourage faster growth of trees within the riparian area, thinning would occur in the outer part of the riparian reserves comparable to the secondary shade zone shown above. Given the conservative protection of the primary and secondary shade zone, no increase in stream temperature is likely. In the long term, faster growth rates of the thinned stands would increase the shade density over time and provide for diversity in the riparian area.

Sediment Delivery

Sediment movement can be episodic or chronic. Typically, the majority of sediment movement happens in response to large storm events. Roads can contribute to episodic events where culverts get plugged. Roads contribute the majority of chronic sediment due to connections between the stream channels and roads from ditchlines and stream crossings. These potential sediment sources are discussed below by activity.

Fuels - There are 769 acres of fuel treatment units outside of harvest units. An estimated 680 acres could be jackpot burned and 89 acres would receive mechanical mastication. Most of the mechanical treatments are mastication of manzanita along the Mad River.

The fuel treatment corridors include approximately 466 acres of treatment within riparian reserves. This includes 150 acres of riparian reserve acres along the Mad River with 40 acres within 160 feet of the river or along smaller streams just above their confluence with the Mad River. Along the Mad River, these include hand treatments and machine mastication of Manzanita on terraces within the riparian reserves on the Mad River. The manzanita is less than 6 feet tall and does not provide shade for the Mad River. The terraces are flat areas with coarse sediments and high porosity. Mastication would cut vegetation to 4 to 6 inches above the ground. It would add to groundcover as the debris is left on site. Given the low slope, high porosity, and addition of groundcover, it is unlikely that measurable sediment movement would occur in these areas.

Fuel treatment corridors would be constructed along the following high-use roads: County Road 504 and NFS system roads 27N34, 27N34D, 27N16, 3S13, 3S05, 3S39, 3S39R, and 2S12. Treatments would involve the thinning of trees generally 12 inches and smaller, cutting of understory vegetation, tree pruning, mastication of brush, lopping/scattering of fuel and jackpot burning, hand or machine piling of fuel and burning of piles. In many areas, these corridors overlap with commercial thinning units and would need minimal additional treatment. Jackpot

burning and pile burning would result in small discontinuous areas where groundcover is removed. In general, fuels treatment corridors are low impact as most activities do not create ground disturbance.

Timber Harvest - Proximity of ground disturbance to streams is an important factor controlling sediment delivery (Rashin et al. 2006). A research study on buffers found that of 212 erosion features within 10 meters (approximately 30 feet) of a stream, 67 percent of the features delivered sediment to the stream. Of 193 erosion features greater than 30 feet from a stream, 95 percent did not deliver sediment to the stream (ibid.).

Elevated sediment delivery to the fluvial system is not likely to occur do to the location of skid trails and landings outside of riparian reserves. These riparian reserves serve to trap sediment as it begins to move off-site. Given no-cut buffers are at least 160 feet on fish-bearing streams and 80 feet on non-fish-bearing streams, it is unlikely that measurable sediment would be delivered to the streams from harvest activities associated with this project.

Design criteria specify that where skyline yarding corridors cross streams, they would require full suspension yarding. Corridors are well spaced and thinning prescriptions would leave down wood and are not likely to expose mineral soil.

Thinning would occur in the outer half of riparian reserves on 530 acres (Table 45). The majority of these would occur with skyline harvest. No equipment or skid trails would occur within riparian reserves where ground-based logging systems are used. Removal of trees from ground-based logging on 97 acres would be with endlining. No heavy equipment would enter riparian reserves associated with thinning treatments. The risk of sedimentation associated with endlining is limited to the dragging of individual trees in the outer 80 feet of the riparian reserve, which has a very low risk of sediment delivery. Helicopter and skyline logging also have very little ground disturbance associated with them. The Six Rivers Best Management Practices Monitoring reports dating back to 2001 show that streamside management zones associated with vegetation treatments has been 100 percent effective in preventing sediment delivery.

Table 45. Logging system for thinning within riparian reserves

Logging system	Alternative 3 acres	Alternative 4 acres	Alternative 5 acres
Ground-based	97	105	109
Helicopter	97	237	128
Skyline	336	275	381
Total	530	618	618

WEPP Model of Harvest - While the Six Rivers National Forest monitoring shows that buffers between streams and vegetation treatments keeps sediment from being delivered to streams, the WEPP model was used to model changes in sediment delivered to streams to show potential differences by alternatives. The WEPP model was originally developed for agricultural and range lands, but has been adapted to forest lands and fuel reduction thinning and burning

treatments by scientists at the Rocky Mountain Research Station (Elliot et al. 1999). Estimate of erosion and sedimentation are not considered absolute values, but rather as estimated values for the purpose of comparing alternatives and identifying general magnitude and duration of effects. Due to the many variables and uncertainties associated with modeling soil movement, the accuracy of predicted erosion or sedimentation is plus or minus 50 percent. The WEPP model tends to overestimate sediment delivery to streams. Modeling results for a ground-based thinning unit and a regeneration unit are shown in Table 46. For the thinning, a unit 180 feet long with a 30 percent slope and an 80-foot buffer was modeled. For the regeneration unit, a cable unit 260 feet long with a 30 percent slope was modeled with 160-foot buffer. For the thinned unit, the average sediment movement was more than double the background levels after harvest but within three years after harvest, the average sediment movement had returned to background levels. For the regeneration unit the estimated sediment delivery doubled after harvest and was still above background levels three years after harvest. The model can take into account a buffer but does not account for other design criteria such as no equipment within the riparian reserve or implementation of BMPs. A wildfire would produce a much higher amount of sediment (Table 46).

Table 46. WEPP model results for harvest units and a wildfire

Year	Thinning slope 30 percent, 80-foot buffer		Regeneration 30 percent slope 160-foot buffer	
	Probability of sediment deliver (percent)	Estimated sediment delivery (tons/acre)	Probability of sediment deliver (percent)	Estimated sediment delivery (tons/acre)
Before harvest	77	0.21	77	0.41
Immediately after harvest	97	0.57	90	0.82
One year after harvest	93	0.48	90	0.78
Two years after harvest	87	0.37	87	0.73
Three years after harvest	77	0.22	87	0.67
Wildfire	100	116 - high severity 9 - low severity		

An EPA report averaged soil disturbance from logging as 21 percent for ground-based, 8 percent for skyline and 4 percent for aerial (U.S. EPA 1993[5]). An assumption was made that sediment delivery by logging system could be based on these same percentages. The estimated delivery of sediment to streams from each alternative is shown below (Table 47). The estimated delivery averages to approximately one-tenth of a yard for each acre harvested. Alternative 3 has

[5] http://www.epa.gov/nps/MMGI/Chapter3/ch3-2e.html

a fractionally higher addition of sediment due to the regeneration harvest. For a hypothetical wildfire of 1,000 acres with 250 acres of high-severity burn and 750 acres of low-severity burn, the estimated cubic yards of sediment produced is 22,280.

Table 47. Potential change in sediment reaching the stream from harvest by alternative

Units	Alternative 1	Alternative 3 addition	Alternative 4 addition	Alternative 5 addition
tons	541	475	418	452
cubic yards	338	297	261	282
cubic yards per acre	0.14	0.12	0.11	0.11

Within the project area, sediment from landslides and debris flows is stored in small headwater channels. Movement of this sediment is episodic. Under normal flow conditions, the headwater channels do not typically have the energy to move large amounts of sediment. In a year with large flow events, these channels will move larger amounts of sediment downstream. It is likely that sediment generated by harvest near these smaller channels would also tend to be stored until a large flow event moved the sediment downstream.

Stream buffers have been designated along fish-bearing, perennial non-fish-bearing, intermittent, and ephemeral with scour stream channels within or adjacent to proposed commercial harvest units. No timber harvesting or fuel treatments would occur within these buffers. The following project design features were incorporated into the proposed action and all other action alternatives. These practices are instituted to insure that there are minimal adverse direct or indirect effects to water quality and the beneficial uses of the Upper Mad River watershed. The buffers are half the width of the riparian reserve.

While the riparian reserves are two site-potential trees (320 feet) for fish-bearing streams, the no-harvest buffers are half this distance (160 feet). All other designated riparian reserves (one site-potential tree or 160 feet) have an 80-foot-no-cut buffer. No ground-disturbing activities would occur within these reserves.

- Steep draws and channels that do not exhibit scour would be protected by excluding equipment from areas. More shallow draws would have designed crossings.
- All temporary roads would be decommissioned upon project completion to reduce the potential for sediment being generated from these roads.
- Unstable and potential unstable landforms have been identified on the ground and would be avoided in harvest units and temporary road layout.
- All applicable best management practices would be employed to protect onsite and offsite water quality (refer to Hydrology Report, Thornton, 2009 for a complete listing).
- The inner half of the riparian reserve would be maintained without thinning. The outer thinned portion of the riparian reserve width would be maintained with an average of 60 percent canopy cover within treated areas of riparian reserves

- No-cut buffers of the full riparian reserve (320 feet) width would be maintained on regeneration harvest units

Landings

Of the 74 helicopter landings, all but 4 currently exist. New landings would add approximately 0.5 acre of disturbance per landing for 2 acres total. Existing landings sometimes receive minor blading or small tree removal. One existing landing off road 59.1 is within the riparian reserve of a flowing spring. No fueling would occur at this landing. Sediment control measures would be used to avoid sediment movement from the landing towards the spring.

Roads

Roads are potentially an important source of increased fine sediment to streams, negatively effecting water quality (Furniss et al. 1991, USDEQ 2008, Wemple et al. 2001, Cook and Desser 2007). Disconnecting the road and stream connection by decommissioning roads or by upgrading culverts, adding cross-drains or diversion dips can improve water quality where elevated fine sediment is an issue. The majority of the roads in the project area would be used for implementation of the project. Many of the roads are outsloped, which minimizes the road stream connection as there are fewer ditch-lines. However, some of the roads such as 2S13L and 3S51are not out-sloped enough, leading to collection of flow on the roadbed and associated rutting and erosion. The addition of rolling dips along these sections of road would help remove the water from the road before erosion occurred.

Pre-haul maintenance would occur on approximately 63.25 miles of road to be used for the project (Rheinberger 2009). Maintenance would extend their functional life and provide better surface drainage, reducing erosion and potential sediment delivery to the stream network. Road maintenance would occur in the dry season prior to haul, and during or after haul if necessary. This would include road upgrades such as the addition of surface aggregate, and replacing deteriorating and failed pipes. Road work would result in additional sediment delivery to the stream during the first few large rain events. However, road reconstruction and maintenance would result in improved road drainage and reduced chronic sediment delivery to the stream network compared to the current condition. It would also lower the risk of larger road failures due to nonfunctioning culverts.

Wet weather haul could occur on up to 30.2 miles of paved or graveled roads. Generally, surfacing helps minimize sediment production from the road surface. However, a study of logging roads concluded that heavily used gravel roads generate up to 130 times more sediment than abandoned roads (Gomi et al. 2005). Another study in the Oregon Cascades reported that 12 log trucks making round-trips each workday from November through January resulted in a 10 percent increase in sediment yield (Luce and Black 2001). Without additional road work, an increase in sediment production from winter haul would be expected. With the following road work a reduction would be expected in the fine sediment delivered to streams from the road system.

To remove the stream-road connection and reduce both chronic and episodic input of fine sediment from roads to streams, the following road improvements would occur; culvert

replacements, diversion dips and additional cross-drains on roads with connected ditchlines (Table 48). These measures would help minimize erosion of the road surface and help disconnect stream and road connectivity.

Table 48. Legacy NFTS road problems within the project area

Road number	Problem 1	Problem 2	Treatment	Estimated miles	Estimated sediment delivery (cubic yards)
2S12D	3 intermittent crossings		580-foot ditchline /outsloping	0.23	554
2S13L	130-foot gully in road		Diversion dips	0.31	-
3S05	2,000-foot ditch connected to stream	7 culverts potential for cascading failures	Additional cross drains	2.25	425
3S31C	Rutting	3 stream crossings, 2 with diversion potential	Diversion dips	1.12	530
3S51	Fill slope gullying,	Bad drainage throughout, plugged culvert	Combination of diversion dips, replace undersized culverts, additional cross-drains	1.45	265
3S51 C	Failed undersized culvert	Generally bad drainage	Combination of diversion dips, replace undersized culverts, additional cross-drains	0.16	159
27N34D	Landslide due to gullying road <6 feet wide in one place	Rilling	Heavy maintenance-Clear road surface-add waterbars	1.21	1,134
Totals				6.73	3,067

Temporary Roads

There are 1.7 miles of temporary road in the riparian reserves. Of this, 0.8 mile is existing non-system road and 0.9 mile is new construction. In reality, most of the new temporary roads are above the stream channel at the top of the riparian reserve. Only road 34-1 is a new temporary road that crosses two draws. While signs of scour were not seen within the draws, there were small litter dams within the draws indicative of flow. Culverts would be used at these crossings.

Of the existing temporary roads, road 29-3 has the largest stream crossing problems. This road has three stream crossings without culverts. At one blocked crossing, runoff runs down the road to a second crossing. The combined energy of both streams has caused the road to fail and created a gully 10 to 12 feet below the road and 4 to 6 feet through the road. Another crossing has cut to a depth of 2 to 4 feet through the road and is adding to a headcut and gullying of another nonsystem road below this one. Road 29-3 is major a sediment problem for Armstrong Creek.

This road would need to be repaired for use, which would improve the present sediment problems. Under all alternatives, this road and all temporary roads would be decommissioned in a hydrologically sound manner with the fill of the crossings removed and the slope returned to an angle considered stable. Generally, after road work there is a short-term risk of increased erosion and associated sediment movement. The erosion is small compared to the fill removed and generally occurs for only the first winter after removal. Risk of sediment movement goes down as vegetation becomes established on the site.

Road Decommissioning

Management-related sediment is estimated at approximately 38 percent for the Upper Mad watershed by the Mad River TMDL. To lower management-related sediment movement and meet the intent of the TMDL, 7.4 miles of system road are to be decommissioned with this project. In addition, 0.87 mile of non-system road not used by this project would be decommissioned, as well as 2.94 miles of nonsystem road used as temporary roads. Short-term increases in sediment from fill removals would occur. A study on the Six Rivers Forest shows that approximately 4.5 percent of the total fill removed is eroded by the stream (Cook and Desser 2007). In general, the first winter after the crossings are removed is the time that most erosion would occur.

The majority of these roads are within the Armstrong Creek area, listed in the TMDL as having approximately 64 percent of sediment from roads. Both 3S51 and 3S51A have low-water crossings of Armstrong Creek. Road 2S12C has a low-water crossing on Deep Hollow Creek used by unauthorized woodcutters removing trees within the riparian reserve. This road is presently being removed by a meander in Deep Hollow Creek that is undercutting the roadbed, directly delivering sediment to a fish-bearing stream.

Removing the listed roads (Table 49) would reduce road-related sediment problems by removing chronic sediment sources where roads either parallel or cross streams. As many of the roads to be removed are within the riparian reserves of Armstrong Creek, the most positive effects would be seen in this drainage. The roads to be decommissioned include 4.4 miles within riparian reserves. Removing these roads would remove an estimated 22 road crossings, including three low-water crossings and 19 culverts.

The roads to be decommissioned that have the most fill are roads 3S53A and 3S55 (Table 49). Road 3S55 already has a 36-inch pipe that has failed and the fill slope is eroding. Removing all the culverts and fill, and laying the slopes back at a natural angle on the roads proposed for decommissioning would reduce the risk of 7,457 cubic yards of fill being eroded and added to streams during future large storm events. If 4.5 percent of this is used as an estimate of sediment added to streams from removing the culverts and fill, an estimated 335 cubic yards of sediment could be added to streams where decommissioning occurs. This is a short-term input of sediment for a long-term improvement in the sediment regime.

Table 49. Roads to be decommissioned

	Surface				Fill removed
Route number	**Aggregate**	**Natural**	**Unknown**	**Total miles**	**Cubic yards**
02S12C	0.75			0.75	0
0305C			0.14	0.14	0
03S39J	0.48			0.48	1,480
03S39S	0.24			0.24	0
03S51		1.45		1.45	265
03S51A		0.58		0.58	0
03S51B		0.33		0.33	0
03S51C	0.16			0.16	159
03S53A	0.50			0.50	3,190
03S53B			0.07	0.07	0
03S55	0.58			0.58	2198
27N02A	1.11			1.11	0
27N18		0.66		0.66	165
27N42		0.35		0.35	0
PK867			0.11	0.11	unknown
PK868			0.08	0.08	Unknown
PK870			0.15	0.15	Unknown
PK871			0.53	0.53	Unknown
Totals	3.81	3.37	1.09	8.27	7,457

Alternative 4

Direct and Indirect Effects

Alternative 4 is similar to Alternative 5 but includes no new temporary roads and no regeneration harvest. Temporary road 29-1 and 30-2 would not be used because they do not presently connect into the road system. However, 29-1 has been identified as a sediment source above Armstrong Creek and would be decommissioned in a hydrologically stable condition with the fill pulled back from stream crossings under all action alternatives. Under this alternative, this road would not be repaired for use so sediment problems would continue until decommissioning occurred.

Road decommissioning includes the same roads as Alternative 3 with the same effects from decommissioning.

This alternative has the fewest acres of ground-based logging. The number of acres helicopter logged increases from 362 to 801 with a corresponding decrease in other methods (see Table 45). With more acres of helicopter yarding, there is lower impact on soils, less potential for ground disturbance and less potential movement of sediment from treated areas to streams. This alternative treats 618 acres within the outer riparian reserve (see Table 45).

Alternative 5

Direct and Indirect Effects

The effect of Alternative 5 is the same as Alternative 3 with no regeneration harvest. This would lower potential sediment movement on the 208 acres that would be thinned instead of having

regeneration harvest. This alternative would be expected to have less sediment delivery to streams from logging than Alternative 3 but more than Alternative 4.

The same temporary roads are used with the same effects as Alternative 3. This alternative includes 618 acres of thinning in the outer part of the riparian reserve. The same road decommissioning would occur with the same effects as under Alternative 3.

Summary of Effects

Effects from fuels treatments, and road decommissioning would be the same under all action alternatives. Alternatives 3 and 5 include building 5.3 miles of temporary roads including crossing two draws, increasing stream road connectivity in the short-term. Alternative 4 does not include road building so there would be no additional effects from roads under this alternative. Alternative 3 treats fewer acres in the riparian reserves but due to the regeneration harvest, has the most potential for an increase in sediment delivery from harvest activities. Alternative 4 has the most helicopter yarding considered the lowest impact logging system and has the corresponding least potential sediment delivery to streams.

Under all action alternatives, there would be a short-term increase in sediment delivery to streams primarily from increased road use and road work. In the long-term, decommissioning would remove 7457 cubic yards of sediment from potential erosion and transport to streams. Road improvements would be expected to stabilize and storm proof culverts approximately 3067 cubic feet of fill along existing roads (Table 47 and Table 50).

In the long term, a drop in both chronic sediment delivery from roads and episodic delivery from road and culvert failures would be expected due to road improvements and decommissioning.

Table 50. Changes in potential sediment delivery by alternative

Activity	Alternative 1	Alternative 3	Alternative 4	Alternative 5
Vegetation Treatments- Cubic yards sediment delivered	0	297	261	282
Road Decommissioning -Cubic yards of fill removed or stabilized	0	7,457	7,457	7,457
Road Improvements-Cubic yards of fill stabilized	0	3,067	3,067	3,067

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives comply with the Six Rivers National Forest Land and Resource Management Plan (LRMP), published in June 1995. Proposed action complies with the Clean Water Act, Porter-Cologne Water Quality Control Act, and applicable water quality control plans.

Compliance with Aquatic Conservation Strategy (ACS)

An integral part of the Northwest Forest Plan, the goal of the ACS is: to maintain and restore the ecological health of watersheds and the aquatic ecosystems within them. The four major components of the ACS (as noted below) provide the basis for protection of watershed health.

1. Riparian reserves were established to buffer streams and other water bodies. Riparian reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply. Standards and guidelines prohibit and regulate activities in riparian reserves that retard or prevent attainment of the Aquatic Conservation Strategy objectives. Riparian reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing waterbodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats. Under the Aquatic Conservation Strategy, riparian reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed.
2. Key watersheds were identified across the Northwest Forest Plan area to serve as the cornerstones of aquatic species recovery.
3. Watershed Analysis: Procedures for conducting analysis that evaluates geomorphic and ecologic processes operating in specific watersheds. This analysis should enable watershed planning that achieves Aquatic Conservation Strategy objectives. Watershed Analysis provides the basis for monitoring and restoration programs and the foundation from which riparian reserves can be delineated. Watershed analysis must be completed prior to management in key watersheds, and riparian reserves.
4. Watershed Restoration: A comprehensive, long-term program of watershed restoration to restore watershed health and aquatic ecosystems, including the habitats supporting fish and other aquatic and riparian-dependent organisms.

Projects that will include management within a riparian reserve must:

- Describe the existing condition, including the important physical and biological components of the fifth-field watershed(s) in which the project area lies,
- Describe the effect of the project on the existing condition; and
- Demonstrate that in designing and assessing the project the decision maker considered and used, as appropriate, any relevant information from applicable watershed analysis.

This work will address these items at a level of detail in proportion to the risk associated with the project.

The project is deemed consistent with the ACSOs if it is designed to contribute to maintaining or restoring the 5th-field watershed condition over the long term, even if short-term effects may be adverse.

ACS Components:

The LRMP contains the components, objectives, and standards and guidelines for the ACS as recommended by the ROD. The four components of the ACS are: 1) riparian reserves, 2) key watersheds, 3) watershed analysis, and 4) watershed restoration.

All action alternatives prescribe management within the riparian reserves. This management was designed to improve the long-term function of the reserves in regard to providing high quality water and fish habitat conditions. This may involve some short-term negative effects that would be offset by long-term improvements. The project area is not in a key watershed. Watershed analysis was completed for the Upper Mad River watershed in 1998. Watershed restoration is planned, including road decommissioning and road drainage improvements.

Of the nine ACS objectives of the LRMP, the following are applicable to the proposed fuel reduction and thinning project:

- 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.
    - Thinning with fuel treatment would occur where wildfire, and resulting fire suppression activities, may alter features to which species are uniquely adapted. Thinning would occur in some of the stands, while jackpot burning or other fuel treatments in others. Treatments proposed within the riparian reserves are designed to reduce excess fuel loads. These treatments would reduce fuel loading and simultaneously leave material to provide diversity and complexity. Reduced fuel loading would help stands progress to toward conditions where the natural fire regime is restored. The proposed action would both maintain and restore the distribution of trees, and thus habitat complexity across these watersheds. Fuel treatments would help maintain the distribution, diversity, and complexity of watershed and landscape-scale features.
- Maintain and restore spatial and temporal connectivity between watersheds.
    - Past timber harvest activities reduced connectivity for a number of riparian-dependent species. The proposed action helps protect future connectivity through accelerating the growth of large trees in plantations and early mature stands through selective thinning and improving the resiliency of the riparian areas and adjacent landscapes in the event of wildfire. Within harvest areas, 2 to 5 snags/acre and 5 to 20 pieces of coarse woody debris would be maintained. Fuel treatment within riparian reserves would be designed to create conditions that minimize disturbance of riparian ground cover and vegetation.

- Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.
  - Riparian reserve and water quality design features protect the existing physical integrity of the aquatic system by keeping all ground-disturbing activities well away from channel banks and riparian vegetation (no mechanical entry of heavy equipment within riparian reserves). Fuel treatment within riparian reserves would be designed to create conditions that minimize disturbance of riparian ground cover and vegetation.
- Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.
  - This project is consistent with riparian reserve guidelines. Water quality is expected to remain at pre-fire conditions. Long-term improvement in water quality would improve due to road decommissioning.
- Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the regime include the timing, volume, rate and character of sediment input, storage, and transport.
  - Reducing the risk of stand-replacing fire and implementing a natural fire regime in the long term would have the most influence on maintenance and restoration of the sediment regime. The long-term total sediment production is predicted to be lower if areas are thinned and fuel treatments occur under controlled conditions, as compared to wildfire. Unstable lands within the project area have been assessed, excluded from treatment, and added to the no treatment sections of riparian reserves. Removing roads would help return to a more natural sediment regime.
- Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.
  - The proposed action would maintain the timing, magnitude, duration and spatial duration of instream flows. Peak flows and low flows would not be altered. Selective thinning treatments outside and within riparian reserves would not have measurable effects on instream flows. Evapotranspiration rates would not be substantially altered by thinning nor would there sufficient ground compaction to alter rates of surface runoff due to the application of standards and guidelines limiting tractor to 15 percent of unit treatment areas.
  - The purpose of thinning within riparian areas is to accelerate the recovery and growth of large trees that have been removed in many areas associated with past harvest activities. There is a need to accelerate the growth of large trees in plantations in order to recover the patterns of sediment and wood routing that are a critical function

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

- Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows.
  - The proposed action protects water tables in meadows and wetlands. These areas are buffered and heavy equipment is excluded.
- Maintain and restore the species composition and structural diversity of plant communities in riparian areas.
  - Species composition of plant communities in riparian areas would be maintained or restored through reducing the risk of stand replacing fire, in riparian areas. Structural diversity would be maintained or restored by leaving snags in areas connected to the aquatic system.
- Maintain and restore habitat to support well-distributed populations of native plant and invertebrate riparian dependent species.
  - A well-distributed mix of riparian habitats would maintain the riparian distributed species. Reducing the risk of a stand replacing fire would increase the likelihood of a well-distributed mix of habitats.
  - This project is consistent with the ACS because it is designed to contribute to maintaining or restoring the watershed condition over the long term, with only minor short-term negative effects.

Cumulative Effects

In assessing cumulative watershed effects for the Beaverslide Project, all past, current and reasonably foreseeable actions on both private and public lands were assessed within all affected watersheds and related to beneficial uses and sensitivities within these watersheds (LRMP p. IV-71, 1-10 and 11) (FSH 2509.22 Ch. 20). Methodology incorporates an Equivalent Roaded Acres (ERA) model used by the Pacific Southwest Region (for more detailed analysis see Hydrology Report).

Cumulative Watershed Effects

In order to assess the potential for the Beaverslide Project to result in added cumulative effects, the extent of road miles and acres of timber harvest, including wildfires within all affected watersheds were assessed. The ERA model is designed to determine whether past and present land management activities in a given watershed approach or exceed a threshold of concern

(TOC) whereby changes in peak flows and hence sedimentation rates might occur. Where ERA results approach or exceed a given watershed's TOC, further field work would be necessary to ascertain whether cumulative watershed effects are present and if land management activities would adversely add to those effects and result in detrimental impacts to beneficial uses.

The ERA methodology has both strengths and weaknesses. Strength of the ERA methodology is the ease with which the analysis can be duplicated and understood. It is also a cumulative watershed effects (CWE) model that incorporates acres 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 model is that it is mostly a computer analysis that is primarily based on management-related hill-slope 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.

Alternative 1

The no action alternative represents the current baseline for the project area. Current ERA percentages with a range of 7.86 to 8.42 (Table 51) for all three watersheds are well below the percent threshold of concern (TOC; Table 55). Lack of road maintenance, failure to reconstruct stream crossings and to close roads would leave sources of sediment production.

The most likely potential adverse impact to cumulative effects could come from a wildland fire. The direct effects of a wildland fire in this area include an increase in erosion, creation of hydrophobic soils, and loss of woody debris. In addition, there could be indirect adverse effects to water quality from increased nutrients from ash, sediment bulking due to accelerated erosion, and loss of control of water creating scouring of stream-banks. If the wildland fire was large in acreage it could lead to detrimental cumulative effects to the watershed in which it occurred.

Table 51. Existing ERA by watershed

Watershed	Watershed acres	ERA from roads, harvest, grazing	2008 fire ERA	Acres	Present existing ERA percent
Headwaters North Fork Eel River	32,982	2,624.71	0	2,624.71	7.96
Lower Tributaries Upper Mad River	27,981	2,199.54	0	2,199.54	7.86
Upper Tributaries Upper Mad River	28,980	2,383.96	54.75	2,438.71	8.42

Action Alternatives

None of the action alternatives would cause adverse cumulative effects. The effect of all action alternatives would increase the ERA percent by less than 1 percent for Headwaters North Fork Eel River and Upper Tributaries Upper Mad River Watersheds and less than 2 percent for the Lower Tributaries Upper Made River Watershed. This is only a slight increase from the current

ERA percentage and is still well below the 12.8 to 14.3 percent thresholds of concern for these watersheds, indicating that there is a low risk relative to cumulative watershed effects and for added detrimental cumulative watershed effects associated with the alternatives (Tables 52-55).

Combined with effects of past, present and foreseeable actions, the alternatives may result in localized increases in suspended sediment during the first few precipitation runoff events following project activities; however, change in peak flow conditions is unlikely. The proposed activities would not result in adverse added cumulative watershed effects that threaten impairment of long-term water quality objectives. Over the long-term, improvements in baseline conditions would occur due to road improvements and road decommissioning.

Table 52. The percent increase in ERA contributed by Alternative 3

Watershed name	Acres	Harvest	Roads	Landings	Fuels	Total ERA	Percent increase in ERA
Headwaters North Fork Eel River	32,982	2.957	0.058	1.250	0.000	4.265	0.013
Lower Tributaries Upper Mad River	27,981	340.087	19.009	20.250	127.340	506.686	1.811
Upper Tributaries Upper Mad River	28,980	34.511	3.405	3.250	27.690	68.856	0.238

Table 53. The percent increase in ERA contributed by Alternative 4

Watershed name	Acres	Harvest	Roads	Landings	Fuels	Total ERA	Percent increase in ERA
Headwaters North Fork Eel River	32,982	2.957	0.000	1.250	0.000	4.207	0.013
Lower Tributaries Upper Mad River	27,981	319.575	0.000	19.000	127.340	465.915	1.665
Upper Tributaries Upper Mad River	28,980	29.222	0.000	3.250	27.690	60.162	0.208

Table 54. The percent increase in ERA contributed by Alternative 5

Watershed name	Acres	Harvest	Roads	Landings	Fuels	Total ERA	Percent increase in ERA
Headwaters North Fork Eel River	32,982	2.957	0.058	1.250	0.000	4.265	0.013
Lower Tributaries Upper Mad River	27,981	341.629	19.009	20.250	127.340	508.228	1.816
Upper Tributaries Upper Mad River	28,980	32.939	3.405	3.250	27.690	67.285	0.232

Table 55. Total ERA percentage values for each watershed by alternative compared to the existing and threshold ERA percentage levels

Watershed name	Existing ERA percent	Threshold of concern	Total percentages		
			Alternative 3	Alternative 4	Alternative 5
Headwaters North Fork Eel River	7.96	13.8	7.97	7.97	7.97
Lower Tributaries Upper Mad River	7.86	12.8	9.60	9.53	9.60
Upper Tributaries Upper Mad River	8.42	14.3	8.64	8.62	8.64

An ongoing travel management project would add slightly to the ERA (Table 56). Kelsey Peak is another project planned for the near future and will be similar to the Beaverslide Project but with fewer acres. A rough estimate of ERA shows that there may be an additional 1 percent for the Lower Tributaries Upper Mad River Watershed and 0.8 percent for the Upper Tributaries Upper Mad River Watersheds with no change for the Headwaters North Fork Eel River Watershed. While the project would add a slight increase to the percent ERA, the total percent ERA would remain below the threshold of concern.

Table 56. Additional ERA from travel management and Kelsey Peak

Watershed	Travel management percent ERA	Kelsey Peak percent ERA	Total addition to percent ERA
Headwaters North Fork Eel River	0.001	0.00	0.00
Lower Tributaries Upper Mad River	0.091	1.00	1.09
Upper Tributaries Upper Mad River	0.032	0.80	0.83

Air Quality

Existing Condition

The project area falls in the North Coast Air Basin and is managed by the North Coast Unified Air Quality Management District (NCUAQMD), which consists of Del Norte, Humboldt, and Trinity counties. As noted in the 1998 Upper Mad River Watershed Analysis (UMRWA, Chapter 3 p. 81), Air quality in the North Coast Air Basin is generally considered good, with all Federal standards consistently achieved (including those for ozone, carbon monoxide, particulate matter, and nitrogen dioxide). The overall area is considered to be in "attainment" by Federal standards, (i.e., has previously and currently meets ambient air quality standards). California state standards for PM_{10} (particulate matter smaller than 10 microns) have not been met. Preliminary results of a source monitoring study by the North Coast Air Quality Management District has attributed substantial amounts of PM_{10} to sea salt and to auto emissions, with smoke being a minor contributor. By following the local Air Quality Management District's open burning regulations

(which address agricultural burning [which includes forest management burns]) all burning would comply with the State Implementation Plan.

Regulatory Agencies

The Environmental Protection Agency (EPA) has the primary federal role of ensuing compliance with the requirements of the Clean Air Act. The EPA issues national air quality regulations, approves and oversees state implementation plans, and conducts major enforcement actions. The EPA established National Ambient Air Quality Standards (NAAQS). To protect human health and welfare, the EPA established primary and secondary NAAQS for the following six criteria pollutants: particulate matter (PM_{10}, $PM_{2.5}$); ozone (O_3); sulfur dioxide (SO_2); nitrogen dioxide (NO_2); carbon monoxide (CO); and lead (Pb). Air quality rules and regulations for the EPA and the standards for these pollutants can be found at http://www.epa.gov/.

In California, the State agency responsible for meeting the Clean Air Act requirements is the California Air Resource Board (CARB). The CARB has further delegated the authorities to local Air Pollution Control Districts (APCDs) or Air Quality Management Districts (AQMDs) for stationary sources, while retaining the authority for mobile sources. Air quality rules and regulations for California can be found at http://www.arb.ca.gov/homepage.htm.

The North Coast Unified Air Quality Management District has the primary responsibility for meeting the requirements of the Clean Air Act. This responsibility is carried out through the development and execution of implementation plans, which must provide for the attainment and maintenance of air quality standards. Air quality rules and regulations for NCUAQMD can be found at their website at http://www.ncuaqmd.org/

Pollutants

Smoke from wildfires and prescribed burns can be a major contributor of PM_{10} levels. PM_{10} is of particular interest to human health. Airborne particles larger than 10 microns get trapped by the body's normal defense mechanisms and are expelled from the body. PM_{10} bypasses these defenses and remains lodged deep in the lungs. Detrimental health effects of PM_{10} can include asthma attacks, reduced lung function, aggravated bronchitis, respiratory disease, cancer and possibly premature death. Immediately affected by PM_{10} emissions are the elderly, children, asthmatics, and people with chronic heart or respiratory disease. Long-term exposure would have more widespread detrimental effects (UMRWA Chapter 3, p. 81).

The NCUAQMD is required to develop and implement an air quality attainment plan with the goal of achieving and maintaining compliance with air quality standards. Table 57 shows estimated (from annual averages) daily emissions for Trinity County in tons per day by source category for Trinity County.

In Trinity County, PM_{10} generally comes from motor vehicles, wood burning stoves, dust from construction and logging operations, wildfires, and slash burning. Trinity County is in “attainment” status for ozone, a product of volatile organic compounds or nitrogen oxides; and is considered “unclassified” for carbon monoxide (CO). Table 57 shows that in Trinity County biogenic sources are the biggest contributors to the production of total organic gases (TOGs) and

reactive organic gases (ROGs). Based on California Air Resource Board (CARB) data, wildfires contribute highest emissions. Wildfires and prescribed burns contribute the most to CO, particulates (PM_{10} and $PM_{2.5}$) and NOx.

Table 57. Estimated daily (from annual average) emissions for Trinity County (tons/day; 2008)

Stationary sources	**TOG**	**ROG**	**CO**	**NO_X**	**SO_X**	**PM**	**PM_{10}**	**$PM_{2.5}$**
Fuel combustion								
Manufacturing and industrial	-	-	-	0.00	-	-	-	-
Food and agricultural processing	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00
Service and commercial	-	-	-	0.00	-	-	-	-
Other (fuel combustion)	0.00	0.00	0.00	0.01	-	-	-	-
Total fuel combustion*	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00
Waste disposal								
Landfills	1.76	0.01	-	-	-	-	-	-
Total waste disposal*	1.76	0.01	-	-	-	-	-	-
Cleaning and surface coatings								
Laundering	0.00	0.00	-	-	-	-	-	-
Degreasing	0.02	0.02	-	-	-	-	-	-
Coatings and related process solvents	0.01	0.01	-	-	-	-	-	-
Adhesives and sealants	0.00	0.00	-	-	-	-	-	-
Total cleaning and surface coatings*	0.04	0.03	-	-	-	-	-	-
Petroleum production and marketing								
Petroleum marketing	0.04	0.04	-	-	-	-	-	-
Other (petroleum production and marketing)	0.00	0.00	-	-	-	-	-	-
Total petroleum production and marketing*	0.04	0.04	-	-	-	-	-	-
Industrial processes								
Food and agriculture	0.00	0.00	-	-	-	-	-	-
Mineral processes	0.00	0.00	0.01	0.00	0.00	0.07	0.03	0.01
Wood and paper	0.03	0.02	0.28	0.01	-	0.08	0.05	0.03
Total industrial processes*	0.03	0.02	0.29	0.02	0.00	0.14	0.08	0.04
Total stationary sources**	**1.87**	**0.11**	**0.30**	**0.05**	**0.00**	**0.15**	**0.08**	**0.04**

Areawide sources	**TOG**	**ROG**	**CO**	**NOX**	**SOX**	**PM**	**PM10**	**PM2.5**
Solvent evaporation								
Consumer products	0.10	0.09	-	-	-	-	-	-
Architectural coatings and related process solvents	0.05	0.05	-	-	-	-	-	-
Pesticides/fertilizers	0.00	0.00	-	-	-	-	-	-
Asphalt paving / roofing	0.58	0.58	-	-	-	-	-	-
Total solvent evaporation*	0.73	0.71	-	-	-	-	-	-
Miscellaneous processes								
Residential fuel combustion	0.85	0.37	5.13	0.09	0.02	0.85	0.80	0.77
Farming operations	1.14	0.09	-	-	-	0.01	0.00	0.00
Construction and demolition	-	-	-	-	-	0.07	0.03	0.00
Paved road dust	-	-	-	-	-	0.81	0.37	0.06
Unpaved road dust	-	-	-	-	-	22.39	13.31	1.33
Fugitive windblown dust	-	-	-	-	-	0.41	0.24	0.03
Fires	-	-	0.00	-	-	-	-	-
Managed burning and disposal	2.01	1.14	36.08	0.01	0.00	2.24	2.15	1.91
Cooking	0.00	0.00	-	-	-	0.01	0.01	0.00
* Total miscellaneous processes	4.00	1.61	41.21	0.09	0.02	26.79	16.92	4.11
Total areawide sources**	4.73	2.32	41.21	0.09	0.02	26.79	16.92	4.11

Mobile sources	**TOG**	**ROG**	**CO**	**NOX**	**SOX**	**PM**	**PM10**	**PM2.5**
On-road motor vehicles								
Light duty passenger (LDA)	0.20	0.19	1.62	0.14	0.00	0.01	0.01	0.00
Light duty trucks - 1 (LDT1)	0.33	0.31	3.09	0.26	0.00	0.01	0.01	0.01
Light duty trucks - 2 (LDT2)	0.14	0.13	1.26	0.15	0.00	0.01	0.01	0.00
Medium duty trucks (MDV)	0.06	0.05	0.54	0.07	0.00	0.00	0.00	0.00
Light heavy duty gas trucks - 1 (LHDV1)	0.02	0.02	0.13	0.02	0.00	0.00	0.00	0.00
Light heavy duty gas trucks - 2 (LHDV2)	0.03	0.03	0.19	0.01	-	0.00	0.00	-
Medium heavy duty gas trucks (MHDV)	0.04	0.04	0.26	0.01	-	-	-	-
Heavy heavy duty gas trucks (HHDV)	0.04	0.04	0.51	0.02	-	-	-	-
Light heavy duty diesel trucks - 1 (LHDV1)	0.00	0.00	0.01	0.03	-	0.00	0.00	0.00
Light heavy duty diesel trucks - 2 (LHDV2)	0.00	0.00	0.01	0.03	-	0.00	0.00	0.00
Medium heavy duty diesel trucks (MHDV)	0.00	0.00	0.01	0.05	0.00	0.00	0.00	0.00
Heavy heavy duty diesel trucks (HHDV)	0.12	0.11	0.45	1.59	0.00	0.06	0.06	0.06

Mobile sources	**TOG**	**ROG**	**CO**	**NOX**	**SOX**	**PM**	**PM10**	**PM2.5**
Motorcycles (MCY)	0.04	0.04	0.28	0.01	-	0.00	0.00	0.00
Heavy duty diesel urban buses (UB)	-	-	-	-	-	-	-	-
Heavy duty gas urban buses (UB)	0.00	0.00	0.01	0.00	-	-	-	-
School buses (SB)	0.00	0.00	0.02	0.01	-	0.00	0.00	0.00
Other buses (OB)	0.00	0.00	0.02	0.00	-	-	-	-
Motor homes (MH)	0.01	0.01	0.16	0.02	-	0.00	0.00	0.00
Total on-road motor vehicles*	1.04	0.97	8.57	2.42	0.00	0.09	0.09	0.07
Other Mobile Sources								
Trains	0.00	0.00	0.01	0.05	-	0.00	0.00	0.00
Recreational boats	1.00	0.93	2.62	0.13	0.00	0.10	0.09	0.07
Off-road recreational vehicles	0.19	0.17	0.61	0.01	-	0.00	0.00	0.00
Off-road equipment	0.11	0.10	0.83	0.22	-	0.01	0.01	0.01
Farm equipment	0.02	0.02	0.11	0.09	-	0.01	0.01	0.00
Fuel storage and handling	0.01	0.01	-	-	-	-	-	-
* Total other mobile sources	1.34	1.24	4.18	0.50	0.00	0.13	0.12	0.09
** Total mobile sources	2.38	2.20	12.75	2.92	0.00	0.22	0.21	0.17

Natural (non-anthropogenic) sources	**TOG**	**ROG**	**CO**	**NOX**	**SOX**	**PM**	**PM_{10}**	**$PM_{2.5}$**
Natural sources								
Biogenic sources	122.15	117.63	-	-	-	-	-	-
Wildfires	21.79	1.55	198.12	6.90	2.13	21.40	20.57	17.45
* Total natural sources	143.94	119.18	198.12	6.90	2.13	21.40	20.57	17.45
** Total natural (non-anthropogenic) sources	143.94	119.18	198.12	6.90	2.13	21.40	20.57	17.45
Grand total for trinity county	**152.92**	**123.82**	**252.39**	**9.96**	**2.15**	**48.56**	**37.78**	**21.77**

Source (published in 2008) http://www.arb.ca.gov/app/emsinv/emssumcat.php

TOG = total organic gases, ROG = reactive organic gases, (CO) = carbon monoxide, SOx = sulfur oxide, NOx = nitrogen oxide, (PM) = particulate matter; (PM_{10}) = particulate matter smaller than 10 microns; ($PM_{2.5}$) = particulate matter smaller than 2.5 microns.

In Trinity County, PM_{10} generally comes from motor vehicles, wood burning stoves, dust from construction and logging operations, wildfires and slash burning. Trinity County is in "attainment" status for ozone, a product of volatile organic compounds or nitrogen oxides; and is considered "unclassified" for carbon monoxide (CO).

Table 57 shows that in Trinity County biogenic sources are the biggest contributors to the production of total organic gases (TOGs) and reactive organic gases (ROGs). Based on California Air Resource Board (CARB) data, wildfires contribute highest emissions. Wildfires and prescribed burns contribute the most to CO, particulates (PM_{10} and $PM_{2.5}$) and NOx.

The potential for large and severe wildfires exists throughout this watershed under late summer conditions. Wildfires would produce significantly greater amounts of pollutants than

prescribed burning, with the potential for greater health impacts to residents and visitors during the summer months (UMRWA, Chapter 3 p. 87). During the extensive fire season of 2008 the community of Ruth experienced 21 days of “unhealthy air quality”, as reported by the NCUAQMD. A State of Emergency due to smoke was declared for the adjacent county of Humboldt.

According to the Six Rivers National Forest LRMP (Chapter 3, p. 2), air quality on the Forest has been considered very good with all Federal standards consistently achieved (including those for ozone, carbon monoxide, particulate matter, and nitrogen dioxide).

Smoke Sensitive Areas

Adjacent to the southern border of the project area is the Yolla Bolly-Middle Eel Wilderness, which is a Class I Wilderness. The North Fork Wilderness is directly adjacent to the south and west of the project area but that is classified as a Class 2 area, as is the rest of the Forest.

The small communities of Ruth, Three Forks, individual residents, resorts, and campgrounds are scattered along the Mad River. Ruth Lake, a long narrow lake primarily used to control flow of water in the Mad River to supply the Humboldt Bay area with drinking water and water for industrial activities is located east and adjacent to the project area. The lake is also used for recreation, irrigation, and hydroelectric power.

Conformity

The conformity provisions of the Federal Clean Air Act, Section 176(c) prohibit Federal agencies from taking any action that causes or contributes to any new violation of the National AAQS, increases the frequency or severity of an existing violation or delays the timely attainment of a standard. The Federal agency responsible for the action is required to determine if its actions conform to the applicable State Implementation Plan. Because the North Coast Air Basin is in an attainment area (federal) no conformity determination is needed for this project.

Desired Condition

The Forest Plan Direction is to maintain air quality at acceptable levels for the protection and use of Forest resources and to meet applicable Federal and State standards and regulations. The adherence to sound smoke management principles is the key element in mitigating the impacts of smoke on air quality and air quality related values and health effects. Smoke management involves the concept of maintaining desired air quality by avoiding unacceptable combinations of concentration, duration, and dispersal of smoke. The central principle of smoke management is to promote dispersion of smoke and other pollutants that have the potential to cause health and visibility impacts. Fugitive dust abatement would occur when necessary to meet air quality standards. The Forest would coordinate with the appropriate air quality regulatory agencies during the planning and implementation of its resource management activities that affect air quality.

Environmental Consequences

Effects Related to Comments or Issues Common to all Alternatives

Comment Statement 1: Concern that the analysis should disclose the amount of carbon emissions expected from these efforts.

- A Smoke management plan (contained in all prescribed burn plans) must be submitted and approved by the NCUAQMD prior to using prescribed fire on Federal lands and carbon emissions (CO) are not a required calculation. However, in an effort to address the concern, the CO emissions that may be produced as a result of the project were estimated using the First Order Fire Effects Model (FOFEM 5.0, Reinhardt et al. 1997). The measurement indicator is tons.

Comment Statement 2: A concern that the project involves the construction of roads in areas with rock types, which could potentially contain naturally occurring asbestos. Compliance with California Code of Regulations Title 17 Section 93105 applies. The harvesting of timber is exempt, but road construction for that purpose is not. Exemptions are possible for activity that is greater than one mile from a sensitive receptor.

- The referenced rules and regulations routinely guide the protocols the Forest Service follows for implementing project activities. Both Heidi Klingel (Forest Intern Geologist) and Juan DelaFuente (Forest Geologist) have reviewed the mapped areas of concern. Areas with ultra-mafic, serpentine, or asbestos bearing rock zones are outside the proposed project boundary. The rock source pits (quarry sites) that may be used for road surfacing within the project area are either sandstone or chert, which does not contain asbestos. Given this information concerning (serpentine and ultra-mafic mapping, rock source) evaluations, and supporting documentation it has been determined that the project complies with NCUAQMD regulation and therefore the concern is not an issue (additional information can be obtained within the Air Report).

Alternative 1

Direct and Indirect Effects

Under this alternative, no treatments would occur, and there would be no emission contribution for air quality degradation. This would lead to increased accumulation of ground fuel, leading to the potential for increased high-intensity wildfires in the future. Wildfires present a risk to the public health and result in damage to both the environment and property. Wildfires are known to result in high levels of emissions and associated NAAQS violation and decreased visibility.

If a wildfire were to occur, the potential indirect effects include degraded air quality and reduced visibility. Consumption of the increased fuel loads and understory biomass would increase the amount of smoke emissions. These emissions would also occur over a period of a few days to several weeks as opposed to intermittent days over several years for a prescribed fire project.

Cumulative Effects

The cumulative effects analysis area is the project area. Past, present, and reasonably foreseeable activities were reviewed to determine cumulative effects to air quality. Because impacts to air quality in regards to smoke from past wildfires and prescribed fire activities are short-lived, past activities do not contribute to cumulative effects. Past activities do influence the amount of available material, which would be available for consumption in the event of a future wildfire.

Presently and within the future gaseous pollutants and airborne particulate matter would continue to be present. Primary contributing emissions sources contributing would include wood burning stoves, motor vehicle exhaust, emissions from recreational campfires, emission associated with prescribed fire, fugitive dust, and wildfires within or adjacent to the project area. Burning associated with foreseeable actions, as well as adjacent agencies or landowners outside of the area can be expected, and would have short-term effects.

Future wildfire frequency is expected to continue as it has been observed in the past. The effects from past prescribed and wildfires activities are no longer a concern because smoke impacts are short-term in nature and are only a concern while smoke is being produced and soon thereafter. However, if an unwanted wildfire occurs in the future these effects could lead to negative cumulative effects. These negative cumulative effects are dependant upon the size and intensity of the unwanted wildfire. Visibility impairment and hazardous health impacts, due to sudden and dramatic releases, are likely with a large unwanted wildfire event. These events may temporarily reduce visibility and air quality. The cumulative effects are unknown, because the intensity and size of a wildfire is unknown. Research has indicated that wildfires can produce nearly twice the amount of smoke as prescribed fire (Huff et al. 1995). The fires in 1999 and 2008 resulted in two States of Emergency as a result of smoke and are estimated to have produced more than twice the amount of a prescribed burn.

Alternatives 3, 4 and 5

Direct and Indirect Effects

The difference in the number of acres treated as well as the treatment type in Alternatives 3 and 4 are not significantly different from Alternative 5 from the perspective of the fire and fuels resource. Because of this, Alternatives 3 and 4 were not analyzed in detail for effects on potential fire behavior or potential crown fire ratings; Alternative 5 provides a representative analysis.

Environmental consequences are based on implementation of the project design features listed in Chapter 2. The estimated acres of burn types are a combination of both commercial thin and fuel treatments outside commercial thin areas. A detailed breakdown of estimated acres by burn type can be viewed in the Fire and Fuels Analysis (Bogardus-Szymaniak 2009). Table 58 shows the modeled emission results (in tons) that could be generated for PM_{10}, $PM_{2.5}$, CO, CO_2, NOx and SOx, by burn type, assuming all acres are burned at one time. Factors that must be considered however are: 1) there is much overlap with burn types therefore total acres are assumed to be over estimated by burn type, 2) the project area would be broken up into smaller

burn units to facilitate burning and 3) burning would occur over a period of about a 10 years, therefore resulting in lower emissions than shown in Table 58 for any given day.

Table 58. Emissions (in tons) from prescribed burning

Burn type	Acres	PM10	PM2.5	CO	C02	N0X	S0X
Handpile and Burn	427	74.9	63.4	799.3	6,154.5	5.3	4.2
Machine Pile and Burn	155	27.2	23.0	290.1	2,234.0	1.9	1.5
Jackpot Burn	1,546	271.3	229.5	2,894.1	22,283.2	19.3	15.4
Total	2,128	373.4	315.9	3,983.5	30,671.7	26.5	21.1

Calculations were generated using the First Order Fire Effects Model (FOFEM 5.0, Reinhardt et al. 1997). Assumptions used in the model: Primary species to be burned is Douglas-fir and fuels are dry.

It is expected that approximately 3,983.5 tons of carbon monoxide (CO) could be generated from projected burning activities over a 10-year period. The action alternatives would produce smoke from prescribed burning activities. Some smoke would be expected to settle into the lower draws and drainages during the evening hours following ignition. This may also result in the form of nuisance smoke, smell or haze during burn days, but all precautions would be taken to minimize smoke impacts on adjacent population centers.

All burning activities would be in accordance with Federal, State, and local guidelines as administered by the North Coast Unified Air Quality Management District. No significant impacts to any Class 1 airshed or sensitive receptor resulting from this project is expected.

The action alternatives would reduce the overall fuel loading on approximately 4,780 acres through various prescriptions that include thinning and fuel reduction. This should result in decreased fire intensity and emissions from any wildland fires occurring in the project area.

Cumulative Effects

Similar thinning projects are being carried out within this watershed. The Little Doe/Low Gulch Timber Sale has been awarded and the Kelsey Peak Project is currently being planned. Other foreseeable actions within the analysis area are precommercial thinning in plantations. There has also been an unknown amount of burning on private lands within this area.

Proposed management activities under Alternatives 3, 4 and 5 combined with past, present, and foreseeable activities noted above would contribute to the emissions that affect air quality. These alternatives and their impacts on air quality are difficult to address in terms of cumulative effects. Large fires have occurred near the project over the past century as described in the Fire and Fuels Analysis (Bogardus-Szymaniak 2009); however, those effects on air quality are gone and cannot be viewed cumulatively. If a wildfire occurred, there is a potential for the NAAQS to be exceeded depending on the size and duration of wildfire.

It is acknowledged that multiple prescribed burn activities, occurring at the same time, could cumulatively increase particulate levels. Generally, the effects of one burn activity are completed before another burn activity begins. Impacts to air quality would generally be confined to no more than a few hours, or at most a few days. The cumulative effect of prescribed fire on air quality is rather short-lived, because once the burn is over and the smoke has dissipated, the effect is over.

However, it is more likely that the current projects will be completed before the Beaverslide Project treatments would be implemented.

Compliance with burn day designations and permits from the NCUAQMD has minimized the effects so that Federal and State air quality standards have not been exceeded from past activities.

The NCUAQMD regulates permissible burn days for prescribed fire use within their district. A Smoke Management Plan (contained in all prescribed burn plans) must be submitted and approved by the NCUAQMD prior to using prescribed fire on federal lands. Overall cumulative emissions are expected to be similar to the past years and are not expected to exceed Federal or State air quality standards.

The improved wildfire suppression capabilities created by these combined thinning and fuel treatment activities should lead to a reduction in size and intensity of wildfires in the treated areas. In the long term, the emissions from wildfires are expected to be reduced as a result of reduced fuel loading.

Transportation System Management

The following discussion provides a description of the current condition of the roads in the project area, management direction, road maintenance, and pre-haul maintenance needs for those routes that would be used as haul routes, and cost analysis for the proposed activity. The need for temporary roads in two alternatives as well as road decommissioning recommendations are also discussed. For a project-specific analysis see Beaverslide Timber Sale and Fuels Treatment Project Roads Analysis Process (2009)

Affected Environment

This project area contains 69.80 miles of system and county roads, including 30.22 miles of collector road and 39.58 miles of local roads. About 5.21 miles are asphalt surfaced, 25.01 miles are surfaced with crushed aggregate, and 39.58 miles are native surfaced. There are 13.11 miles of road within the project area that do not access harvest units or are not used as haul routes. These roads are not scheduled for maintenance or pre-haul maintenance and will not be discussed further.

The road density in the project area is 3.3 miles/square mile. Currently, several miles of road in the project area are closed. Closures include both active closure by the district and roads that have closed due to vegetative growth, blow down, road failure and/or disuse.

Road 02S05 is the major northwest - southeast corridor on the western boundary of the project area. Road 02S05, is a single-lane gravel road used for recreation and resource management. This road has been recently maintained by the district (blading and ditch cleaning).

Road 504 (county road) is a major double-lane paved road on the eastern side of the project area along the Mad River. This road would be the main haul route out of the project area to State Highway 36.

Roads 27N34, 03S31, 03S13, 02S13, 02S12, and 03S05 are single-lane gravel collector roads within the project area that run primarily from Mad River (504 road) to the ridge top (02S05 road). Most of these roads have had some recent maintenance but would need additional work before timber haul begins. Many of the short, native-surfaced local roads that branch off of these collector roads would need varying amount of work ranging from light brushing and blading to overgrown vegetation removal and, to a lesser degree, drainage structure maintenance and culvert installation. Some of these local roads are completely overgrown and need to be re-opened.

Existing road-specific needs and costs in addition to detailed information for all roads are displayed in the Roads and Transportation Report (Rheinberger 2009) and in the Hydrology Report (Thornton 2009).

Road-related Issues and Evaluation Criteria

The current road system was built to access timber and other forest resources. Timber sale revenues paid for the majority of past construction and road maintenance. However, timber harvest has declined with the current shift toward ecosystem management. The change in forest management has seriously reduced the operating budget and the ability to maintain such an extensive road system. A consequence is that most roads are no longer annually inspected for maintenance requirements and deficiencies are not corrected and could result in extensive resource damage. Some roads may need to be removed from the system, others closed until future access is needed, and many roads are managed at the lowest possible maintenance level.

There is a concern that costs associated with project implementation could be prohibitively high. Many roads need to have various levels of pre-haul maintenance and maintenance in order to bring them up to safe log haul standards and reduce the potential impacts to other resources. High project costs for roads could suppress bid prices or discourage some potential bidders. Costs of concern include temporary road construction, system road pre-haul maintenance, road maintenance, and road decommissioning. Issues related to road costs will be evaluated by alternative in the project's economic analysis report. Measurement criteria related to road costs include:

- Miles and cost of new temporary road construction
- Miles and cost of road maintenance for existing roads
- Miles and cost of system road pre-haul maintenance (work performance) for existing roads
- Miles and cost of road decommissioning

Existing Road Maintenance and Pre-haul Maintenance

All haul routes in the three action alternatives would receive maintenance and/or pre-haul maintenance work. Pre-haul maintenance road work (also known as "work performance") is described below. Road maintenance collections for post-haul road work are also described below.

Pre-haul Maintenance: Work may consist of brushing of roadside vegetation, falling of danger trees, blading of roadbed, maintaining drainage structures, removing slough and slide

material, removing ruts, opening overgrown roads, dust abatement, and spot-rocking road surfaces where needed. In addition, culverts may be installed or replaced where needed. These activities should occur on all haul roads before commercial activity occurs.

Maintenance: Work would consist of pre-haul maintenance to restore the road condition. Such activities as surface rock replacement and general maintenance are included. This work could occur during log haul if road work is needed to insure the safe use of the road. Table 59 displays a summary of miles of maintenance/pre-haul maintenance needs by alternative.

Table 59. Existing road pre-haul maintenance and maintenance summary (miles)

Work type	Alternative 1	Alternative 3	Alternative 4	Alternative 5
Pre-haul maintenance	0.00	63.25	63.25	63.25
Maintenance	0.00	63.25	63.25	63.25

Existing Road Maintenance and Pre-haul Maintenance Costs

Road pre-haul maintenance (work performance) and maintenance were estimated using the Six Rivers National Forest Maintenance Worksheet. Table 60 summarizes the estimated costs. Since all the action alternatives would use the same existing roads, the estimated total costs are the same. However, the cost per unit volume hauled (i.e., MBF) will differ.

Table 60. Estimated costs for pre-haul maintenance and maintenance of existing roads (dollars)

Alternative	MBF volume	Pre-haul maintenance cost	Maintenance cost	Total cost	$ / MBF
Alternative 1	0	0	0	0	0
Alternative 3	28,100	418,371	268,430	686,801	24.43
Alternative 4	24,000	418,371	268,430	686,801	28.61
Alternative 5	24,000	418,371	268,430	686,801	28.61

Temporary Road Construction

All alternatives would require the use of existing non-system roads (closed temporary roads from previous timber sales) and/or the construction of new temporary roads. The original NFS road system was constructed to accommodate large towers that were used to log large tracts of lands. Thinning activity uses small, mobile, land-based yarders that have limited reach. Therefore, in several cases short temporary spur roads would be needed to accommodate planned harvest systems. Temporary road construction has been kept to a minimum in Alternatives 3 and 5, utilizing existing non-system roads wherever possible. Alternative 4 would only use existing non-system roads. All temporary roads, new and existing, would be decommissioned after harvest activities are completed. Table 61 displays the planned temporary road mileage by alternative.

New Temporary Road Construction Costs

The new temporary haul roads planned for the Beaverslide Project are generally located on gentle terrain or ridgetops. They are needed to fit the planned logging system for a given alternative to minimize costs where possible. The estimated costs displayed in Table 62 include the cost to decommission the road after logging. The costs were estimated using time, materials, equipment, and labor estimates. These costs do not include skyline-tractor swing roads (included in the logging system costs – see economic report).

Table 61. Temporary roads (miles)

Work type	Alternative 1	Alternative 3	Alternative 4	Alternative 5
Miles of new temporary road constructed	0.00	5.30	0.00	5.30
Miles of existing non-system road reutilized	0.00	2.90	1.70	2.90

Table 62. Estimated costs for new temporary roads, which includes closure and scarification (dollars)

Alternative	MBF volume	Temporary road construction cost	$ / MBF
Alternative 1	0.00	0.00	0.00
Alternative 3	28,100	67,364	2.40
Alternative 4	24,000	0.00	0.00
Alternative 5	24,000	67,364	2.81

Road Decommissioning

As a part of the Beaverslide Project, several NFS system roads, existing non-system roads, and unauthorized roads would be decommissioned. Under all alternatives, 7.4 miles of system road and 0.87 mile of unauthorized road would be decommissioned. Under Alternative 4, an additional 0.83 mile of existing non-system road located within harvest units but not used for log haul would be decommissioned. The estimated cost of decommissioning roads is highly variable but has been estimated at $10,000 per mile by the Six Rivers National Forest Supervisors Office. The proposed decommissioning would lower the road density from 3.3 miles per square mile to 2.9 miles per square mile for Alternatives 3, 4, and 5. Table 63 below displays the decommissioning miles and estimated cost.

Table 63. Miles of road proposed for decommissioning and estimated cost (dollars)

Alternative	MBF volume	Miles to decommission	Cost to decommission	$ / MBF	Road density after decommissioning
Alternative 1	0.00	0.00	0.00	0.00	3.3 mi/sq mi
Alternative 3	28,100	8.28	82,800	2.95	2.9 mi/sq mi
Alternative 4	24,000	8.28	91,100	3.80	2.9 mi/sq mi
Alternative 5	24,000	8.28	82,800	3.45	2.9 mi/sq/mi

Cultural Resources

The National Historic Preservation Act (NHPA) requires protection of all significant cultural resources, including archeological sites. In compliance with the Region 5 Programmatic Agreement with the State Historic Preservation Office (SHPO) for the process of Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region, historic and prehistoric cultural sites have been identified and protected.

An archaeological reconnaissance was conducted on the project area and recorded in a Cultural Resource Inventory Report, which is on file in the Heritage Department of the Six Rivers National Forest Supervisor's Office. Standard resource protection measures have been applied to those sites in and near the area of potential effect (APE). The alternatives considered would not affect districts or sites listed in, or eligible for listing in, the National Register of Historic Places. The following design/mitigation measures are in place for all action alternatives:

- Any known eligible cultural sites would be protected through avoidance.
- If new cultural resources are discovered during project implementation, all work would cease in that area until assessed by an archeologist.
- Monitoring for archeological sites would occur throughout project implementation activities with priority being given to road and landing construction and reconstruction, harvesting, and burning activities.
- In some treatment units, post-clearing surveys would be completed in areas too dense to survey before treatment, per Programmatic Agreement with the State Historic Preservation Office and the Federal Advisory Council on Historic Preservation, "Interim Protocol for Non-Intensive Fuels and Vegetation Reduction Projects."

Social Environment

Recreation and Scenery Management

The Forest Plan requires that the scenery resource visual quality objective (VQO) and recreation resource recreation opportunity spectrum (ROS) classes be met for the project area. The recreation and scenery resource analysis were completed and the appropriate design features were developed and are part of the project design features common to all action alternatives in Chapter 2. The implementation of these design features would ensure each action alternative complies with the LRMP standards and guidelines for Visual Quality Objectives (VQOs) and Recreation Opportunity Spectrum (ROS) classes. Additional scenery and recreation issues were not studied in detail but were addressed (Bonnett 2009a and 2009b).

Economic Analysis

Economic efficiency is the determination of the cost of planning and implementing forest management treatments and the benefits or revenues those treatments generate. Forest Service Manuals (2430-2432) and Handbook (2409.18 Chapters 10-30) require financial and economic efficiency information be available to the decisionmaker prior to substantial investment of capital and resources in timber sales. The proposed action of thinning treatments achieves forest management objectives; therefore, the sale of timber is necessary to achieving those objectives. Revenue produced from this timber is considered an offset to the cost of accomplishing the project.

Existing Conditions

The high cost of planning and implementing a timber sale project may affect the overall economic efficiency of the project. The economic efficiency of this project will be analyzed in two ways:

1. The economic viability of the tool used to achieve the forest management objectives – for example a timber sale
2. The economic efficiency of the project as a whole – for example the timber sale plus other, “non-timber sale” projects

The economic viability of the timber sale is primarily dependent on the type and cost of the yarding systems used, the cost of road management work, the cost of harvest-generated fuel treatments, the cost of log haul, and the cost of mitigating measures to reduce effects. In addition, the local delivered price paid for wood products or logs produced from sale of the timber is also a crucial factor. Timber sale economic viability can be measured by the difference between the value of the timber at the estimated bid rate and the value at the established base rate or minimum rate.

The economic efficiency of the project as a whole is primarily dependent on the timber sale economic viability as well as the cost associated with planning the project, the cost of designating and preparing the timber sale on the ground, the cost of administrating the timber sale, and the cost of other resource improvement projects within the project area not associated with the timber sale.

Timber revenues are returned to the U.S. Treasury and a proportion of the revenues re-distributed back to local county governments. The overall project contributes to employment and income generated by management activities across the Forest by generating benefits to the economy by providing timber products, direct and indirect employment from the planning and implementation of the project, and the employment from processing, production, and manufacturing of the raw wood material.

Direction for the financial efficiency analysis can be found in the Forest Service Manual 2430-2432 (Amendments 2400-95-1 through 3) and Forest Service Handbook 2409.18, Chapters 10-30 (Amendments 2409.18-95-1 through 6). The financial efficiency analysis for the

Beaverslide Project activities provides information relevant to the future Forest financial position of the program if the project is implemented. The analysis compares estimated Forest Service direct expenditures with estimated financial revenues. Financial efficiency analysis measures two things – revenue/cost ratio and financial present net value.

A detailed financial efficiency analysis was completed for the project. This analysis includes revenues generated from timber sale receipts, associated with project planning, timber sale preparation and administration, road decommissioning, and fuel reduction treatments not associated with commercial harvest units. The analysis did not include an estimate of non-market amenities values due to the unpredictable nature of these values. Non-market values are required "only when excess demand exists for non-market goods" (Forest Service Handbook 2409.18 32.24) or the project has detrimental effects on non-market output. For a comprehensive discussion of the social and economic considerations at the forest level, refer to the Six Rivers Land and Resource Management Plan, Chapter III and Chapter IV.

Environmental Consequences

Direct and Indirect Effects

The potential timber sales resulting from the action Alternatives 3 and 5 appear to be economically viable. The timber sale resulting from Alternative 4 does not appear to be economically viable. None of the action alternatives would have a positive economic return in terms of the project as a whole. The no action alternative (Alternative 1) would have a negative economic return due to the money spent on the planning effort without a return from the harvesting of revenue-producing timber.

Timber Sale Economic Viability

Potential timber sales resulting from the Beaverslide Project includes thinning and regeneration harvest of merchantable timber by several logging systems. Table 64 summarizes the proposed volumes and acreages by logging system for each alternative.

Table 64. Timber sale acres and volume by alternative and logging system

Alternative	Acres ground based	Acres skyline	Acres helicopter	Total acres	MBF ground based	MBF skyline	MBF helicopter	Total MBF
Alt1	0	0	0	0	0	0	0	0
Alt 3	607	1,413	362	2,382	7,161	16,669	4,270	28,100
Alt 4	593	1,076	802	2,471	5,759	10,451	7,790	24,000
Alt 5	619	1,458	394	2,471	6,012	14,161	3,827	24,000

The economic viability of the potential timber sales associated with the alternatives is summarized below (Table 65). These potential timber sales were analyzed as a whole for a given alternative. For example, all potential thinning units, regeneration units (Alternative 3 only), harvest volumes, harvest acres, logging systems, and costs were lumped together for a given

alternative. In some cases individual treatment units or groups of treatment units may not be economically viable when considered separately or grouped by logging system (for example units grouped by the helicopter logging system only).

A timber sale is considered economically viable when the revenue produced from the sale of the timber exceeds the value of the same timber at some minimum or base rate established by the Government. The difference between the value of the timber at the estimated bid rate and the value at the base rate can be used as measure of timber sale economic viability. The economic return to the Government for the sale of timber includes the cost to harvest, haul, manage roads, treat harvest-generated fuel, and conduct other mitigating measures required in the timber sale contract.

A viable timber sale would likely result in the resource management treatments proposed by a given alternative being implemented since the timber sale would be the vehicle by which the projects are undertaken. Table 65 summarizes and compares the timber sale economic viability of the potential timber sales resulting from the alternatives. The estimated rates are based on the average delivered log price, logging costs, log haul costs, road related costs, slash mitigation costs, and other contractual costs.

Table 65. Timber sale economic viability

Alternative	Harvest volume MBF	Estimated bid rate $ / MBF	Total dollars at bid rate	Base rate $/MBF	Total dollars at base rate	Difference bid-base
Alt 1	0	n/a	n/a	n/a	n/a	n/a
Alt 3	28,100	16.03	450,443	4.77	134,037	316,406
Alt 4	24,000	-19.29	-462,960	1.00	24,000	-486,960
Alt 5	24,000	6.32	151,680	1.00	24,000	127,680

Table 65 shows that timber sales resulting from Alternatives 3 an 5 both appear to be viable based on the positive difference between the timber values at the estimated bid rates and the values at the base or minimum rates (last column in the table). The timber sale resulting from Alternative 4 is not viable mainly due to the increased amount of helicopter logging associated with it (i.e., high logging costs).

Alternatives 3 and 5 differ by approximately $188,726 based primarily on the additional total volume and volume per acre produce through several regeneration harvest units incorporated into Alternative 3 (i.e., lower logging costs). Alternative 3 also has an additional tree-planting cost associated with it for the regeneration harvest units (reflected in the increased base rate or $4.77/MBF). Alternative 1 (no action) produces no timber volume and therefore was not analyzed in terms of timber sale viability.

Note that the timber sale economic viability is largely based on the likely delivered log price that can be expected at the time of the actual timber sale (i.e. the revenue side of the economic equation). Currently the timber industry in the northern California area is suffering through a

serious economic recession (as is the whole U.S. economy). Therefore, the delivered log prices are at a historically low rate in the area. These low prices were used in this analysis.

Economic Efficiency – Beaverslide Project as a Whole

The economic efficiency of the alternatives as a whole is summarized below. This analysis includes not only the timber sale economics (see Table 65), but also the cost associated with planning the project, the cost of designating and preparing the timber sale on the ground, the cost of administrating the timber sale, and the cost of "other" projects not associated with the timber sale. These "other" costs include existing road decommissioning and hazardous fuel reduction costs not funded by the timber sale. The assumption is that 50 percent of the fuel reduction costs would come from funding sources not associated with the timber sale. The purchaser would be responsible for covering the cost of harvest-generated fuel, and funding sources other than timber sale receipts would cover the cost of treating existing fuels within commercially treated units, stand-alone fuel units, and fuel-treatment corridors.

Note that the additional costs in the Beaverslide Project as a whole would not affect the timber sale viability since the funding sources are not supported by the timber sale. Table 66 below summarizes overall economic efficiency resulting from the alternatives.

Table 66. Economic efficiency – Beaverslide Project as a whole

Alternative	Real discount rate	Discounted costs	Discounted revenues	Net present value	Benefit cost ratio
Alt 1	4.00%	516,600	0	-516,600	0.0000
Alt 3	4.00%	8,533,875	7,534,209	-999,666	0.8829
Alt 4	4.00%	8,114,089	6,434,911	-1,679,178	0.7931
Alt 5	4.00%	7,551,795	6,434,911	-1,116,884	0.8521

Alternative 1 (no action) has a negative present net value because no benefits are produced (i.e., timber) to offset the cost of planning the project. Alternatives 3, 4, and 5 also have negative net present values and revenue/cost ratios less than 1.00. The differences between the action alternatives correspond to the acres of fuel treatments and harvest volumes in each action alternative funded by the respective timber sales and reflected in the discounted revenues (timber sale receipts).

Cumulative Effects

The cumulative effects of an alternative on the socioeconomic environment are quite difficult to estimate. In terms of cumulative effects, district or forest timber volumes for auction may have little influence on any one mill. For example, an owner can purchase from Bureau of Land Management and private woodlot owners to get additional supply. They can also purchase logs from other surrounding national forests. Or, at the owner's choice, they can increase or reduce the size of the mill operation, sell the operation to another company, or simply close the mill. All of

these have occurred in the last decade and few, if any, of the changes to companies or communities can be tied directly to the sale of the Six Rivers National Forest timber.

Alternative 1 (no action) would not produce any timber volume and does not provide timber volume to the Forest's probable sale quantity. Alternatives 3, 4, and 5 would produce approximately 24,000 to 28,100 MBF. This timber volume represents about 50 percent of the Six Rivers National Forest's probable sale quantity for fiscal years 2010 and 2011. The timber volume produced from the action alternatives would have few cumulative effects to the economy of northwestern California and southern Oregon given the rather large timber landbase in these areas.

Summary of Effects

The potential timber sales resulting from Alternatives 3 and 5 appear to be economically viable. The timber sale resulting from Alternative 4 does not appear to be economically viable. None of the action alternatives would have a positive economic return in terms of the project as a whole. The no action alternative (Alternative 1) would have a negative economic return due to the money spent on the planning effort without a return from the harvesting of revenue-producing timber. Cumulatively, the timber volume produced from the action alternatives would have few effects to the economy of northwestern California and southern Oregon given the rather large timber landbase in these areas.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short-term uses, and their effects, are those that occur within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained-Yield Act and the National Forest Management Act, all renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if the long-term productivity of the land is maintained. This long-term productivity is maintained through the application of the project design features described in Chapter 2, in particular those applying to the soil and water resources.

Under Alternatives 3, openings would be created in regeneration cutting units in the short-term, but well-stocked vigorous stands would be established for the long term as a result of post-harvest reforestation and stand tending. Alternatives 3, 4, and 5 would provide timber products, in decreasing yields, to benefit consumers in the short-term. With Alternatives 3, 4, and 5, there would be a very short-term increase in fuel hazard in the period between harvesting and activity fuel treatment. This would be accompanied by a long-term increase in stand vigor, a reduction in fuel hazard, and a corresponding decrease in the risk of stand-replacing fire occurring within the harvest units. There would also be a 3- to 5-year increase in fuel hazard from post-harvest treatments and a corresponding increase in stand vigor as discussed in the Fuel section of this chapter.

Under Alternatives 3 and 5, the use temporary roads would provide improved efficiencies in cost-effectively providing timber products from those units where access needs warrant their use. Subsequent road decommissioning of these temporary roads would produce beneficial long-term effects to the beneficial uses of water from reduced sediment delivery into stream channels with either of these alternatives, as discussed in the Water Quality/Watershed Condition section of this chapter.

Alternative 3 would thin 301 acres and Alternative 4 and 5 would commercially thin (thin from below) 330 acres of nesting/roosting northern spotted owl habitat that may cause short-term habitat degradation. This would allow the development of healthy, more vigorous stands that are more sustainable for those habitat values in the long term. These effects are discussed in the Wildlife section of this chapter.

Unavoidable Adverse Effects

Implementation of any action alternative could cause some adverse environmental effects that cannot be effectively mitigated or avoided. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of other resources. Some adverse effects are short-term and necessary to achieve long-term beneficial effects. Many adverse effects can be reduced, mitigated, or avoided by limiting the extent or duration of effects. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or lessen the significant adverse consequences to resource protection standards of the Six Rivers National Forest Land and Resource Management Plan. The application of project design features was intended to further limit the extent, severity, and duration of potential effects. Such measures are discussed throughout this chapter. Regardless of the use of these measures, some adverse effects would occur.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, cultural resources, or the extinction of a species. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the resource has been destroyed or removed. No irreversible commitments of resources were identified.

Irretrievable commitments apply to the loss of production, harvest or use of natural resources. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production. The only irretrievable commitment of resources relative to the project under the action alternatives would be the use of aggregate from existing rock sources for routine road maintenance.

Cumulative Effects

Cumulative effects have been discussed in the individual sections for resource areas earlier in this chapter, whenever applicable. Action alternatives including regeneration cutting, if implemented and added to the effects of other past and current timber sales in the Six Rivers South Vegetation Zone, would result in seral stages well within the recommended management ranges defined in the LRMP. The amount of late-successional forest within the watershed would remain well above the 15 percent threshold established in the LRMP, as discussed in the Vegetation section of this chapter.

The combined effects of implementing any action alternative with the other timber sales in the assessment area would have the beneficial effect of accelerating the succession of early to mid-mature stands to late-successional vegetation in the landscape.

There would be no loss of suitable nesting/roosting habitat under any action alternative and only 301 acres under Alternative 3 and 330 acres under Alternatives 4 and 5 would be thinned causing possible degradation. These effects are discussed in more detail in the Wildlife section of this chapter.

The cumulative effects of implementing the action alternatives, in conjunction with other timber harvesting activities in the watershed, would not lead to losses in suitable habitat for northern goshawk, Pacific fisher, American marten, western pond turtle, northern red-legged frog, or foothill yellow-legged frog across the watershed. These cumulative effects may result in minimal effects on individuals and not lead to losses in viability to populations, as discussed in the Wildlife section.

At the watershed scale, the action alternatives, if implemented, would result in minor cumulative effects that would in turn result in the existing ERA watershed values remaining well below the watershed's threshold of concern. The cumulative watershed effects of implementing the action alternatives in conjunction with other management activities would range from none to low impact and minor. Due to all ground disturbing activities occurring outside of the inner one half of the riparian reserves, there would be no measurable increase in runoff and sedimentation that would lead to a decline in water quality under any of the action alternatives, as discussed in the Watershed section. Moreover, the action alternatives are consistent with the Aquatic Conservation Strategy objectives.

At the project scale, the application of project design features and Best Management Practices on timber harvesting and associated activities under the action alternatives would minimize any cumulative effects on nutrient cycling and the soil's strong buffering capacity would reduce the possibility of any measurable long-term cumulative effect on soil productivity. Guidelines for maintaining soil productivity would be met as discussed in the Soil Productivity section.

The silvicultural and fuel treatments and the fuel corridors which are common to all three action alternatives is expected to help reduce fire hazard by reducing surface fuels and fuel laddering over the long term.

Energy Requirements, Conservation Potential, Depletable Resource Requirements

Consumption of fossil fuels would occur with the action alternatives during logging and hauling timber and during the decommissioning of temporary roads. However, there are no unusual energy requirements associated with this proposal nor is it the type of proposal that provides an opportunity to conserve energy at a large scale.

Wood is a renewable resource. With the proper application of the project design features and best management practices intended for the activities to be in compliance with Forest Plan standards and guidelines, soil productivity would be conserved as discussed in the Soil section.

Prime Farmland, Rangeland and Forest Land

The project area does not contain any prime farmland or rangeland. Prime forest land does not apply to lands within the National Forest System.

Possible Conflicts with other Land Use Plans

The proposed action and action alternatives would take place entirely on National Forest System land. Only small amounts of private land lie adjacent to the project area. These alternatives are not in conflict with planning objectives for Trinity County or local tribes.

Environmental Justice

Executive Order 12898 relating to environmental justice requires an assessment of whether minorities or low-income populations would be disproportionately affected by proposed actions. An environmental justice issue arises when conduct or action may involve a disproportionately high and adverse environmental or human health effect on identifiable low-income or minority populations. To determine this, an analysis was conducted on potential impacts to work opportunities, subsistence consumption and human health and safety. The outcome of this analysis was based primarily on current socio-economic information found in the Upper Mad River Watershed Analysis (pg. 91-95) and the Social/Economic Environment section of the LRMP FEIS (III-75).

Local Indian tribes and the general public were notified of this project and provided an opportunity to provide comments by way of the public participation process described in Chapter 1 of this document. No comments from the public and minority groups on these issues were received on this project through this public participation process.

Anticipated effects on minorities or low-income people are variable with the no action alternative. Not creating any new work opportunities could disproportionately affect low-income populations in the Northern Province counties. No change in subsistence consumption is anticipated. The risks to human health and safety are not expected to change from the current condition under the no action alternative.

The action alternatives could provide new short-term work opportunities that could benefit low-income populations in the Northern Province counties. Also, the action alternatives would avoid adverse impacts to public safety through expert project design consistent with all laws and regulations. Either action alternative would include standard public health and safety clauses in all contracts. Actions such as dust abatement, signing of roads identifying the area as an active timber sale, safely securing truckloads, and maintaining the haul route, are standard precautionary measures. Subsistence consumption is not expected to change from the current pattern.

In conclusion, there are no environmental justice issues affecting human health or the environment that would have an adverse effect on minority or low-income populations through the implementation of the action alternatives.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders.”

Under the Endangered Species Act of 1973, as amended, Section 7(a)(2), the Forest Service shall, in consultation with and with the assistance of the Secretary of the Interior (U.S. Fish and Wildlife Service), insure that any action is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical

habitat. There are no endangered or threatened fish species that would require consultation with the National Marine Fisheries Service. The Forest Service has completed a biological assessment and found that the action alternatives **may effect but will not adversely affect** the northern spotted owl. There are no other listed species associated with this project. Informal consultation with the U.S. Fish and Wildlife Service will be concluded with a letter of concurrence.

Under the National Historic Preservation Act, consultation has been completed with the State Historic Preservation Office. A Cultural Resource Inventory Report has been completed. Standard resource protection measures have been applied to those sites in and near the Area of Potential Effect (APE). The alternatives considered would not affect districts or sites listed in, or eligible for listing in, the National Register of Historic Places.

Chapter 4. Consultation and Coordination

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

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FEDERAL, STATE, AND LOCAL AGENCIES:

Environmental Protection Agency
USDI Fish and Wildlife Service
California Department of Fish and Game
California Regional Water Quality Control Board, North Coast Region
North Coast Unified Air Quality Management District

TRIBES:

Round Valley Indian Tribes
Table Bluff Reservation - Wiyot Tribe

Distribution of the Draft Environmental Impact Statement

This environmental impact statement has been distributed to the listed individuals who specifically requested a copy of the document. In addition, copies have been sent to the listed Federal agencies, State and local governments, and organizations representing a wide range of views.

American Forest Resource Council, Richard Svilich
California Native Plant Society, Jennifer Kalt
California Regional Water Quality Control Board, North Coast Region Attn: Kaete King
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U.S. Department of Energy, Office of NEPA Policy and Compliance
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Appendix A – Proposed Treatments by Alternative

The tables in this section provide unit-by-unit information of proposed treatments by alternative. Abbreviations are:

PH	Pole past harvest	EA	Early mature with co-dominates
EM	Early mature	LTA	Leave tops attached
EH	Early mature past select harvest	LS	Lop and scatter
EA	Early with predominates	GP	Grapple pile
MM	Mid-mature	JPB	Jackpot burn
MH	Mid-mature past selection harvest	NT	No treatment
MA	Mid-mature with predominates	HP	Hand pile

Table 67. Alternative 3 treatments by unit

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
Commercially Thin (Thin from Below)						
1a	EH	skyline	LTA/LS/JPB	109	7	16
1c	EH	ground based	LTA/LS-GP/JPB	185	7	26
1d	EH	skyline	LTA/LS/JPB	59	7	8
1e	EH	skyline	LTA/LS/JPB	63	7	9
2a	EM, MM	skyline	LTA/LS/JPB	203	11	18
2b	EM, MM	ground based	LTA/LS-GP/JPB	64	11	6
2e	EM, MM	ground based	LTA/LS-GP/JPB	12	11	1
3a	PH	skyline	LTA/LS/JPB	42	4	11
3b	PH	ground based	LTA/LS-GP/JPB	17	4	4
3c	PH	skyline	LTA/LS/JPB	16	4	4
4a	MA	ground based	LTA/LS-GP/JPB	45	10	5
4b	MA	ground based	LTA/LS-GP/JPB	38	10	4
7a	PH-EH	ground based	LTA/LS-GP/JPB	38	7	5
7b	PH-EH	skyline	LTA/LS/JPB	82	7	12
8a	EH, MM	skyline	LTA/LS/JPB	1252	8	156
8b	EH, MM	ground based	LTA/LS-GP/JPB	10	8	1
8c	EH, MM	skyline	LTA/LS/JPB	25	8	3
8d	EH, MM	helicopter	NT	43	8	5
8e	EH, MM	skyline	LTA/LS/JPB	68	8	9
9a	EH, MM	skyline	LTA/LS/JPB	231	11	21
9b	EH, MM	skyline	LTA/LS/JPB	67	11	6
9c	EH, MM	ground based	LTA/LS-GP/JPB	131	11	12
9d	EH, MM	helicopter	LS/JPB	127	11	12
10	EA	ground based	LTA/LS-GP/JPB	225	6	37
11a	EM	skyline	LTA/LS/JPB	141	8	18
11b	EM	ground based	LTA/LS-GP/JPB	24	8	3
12	EM	ground based	LTA/LS-GP/JPB	90	3	30

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
14	MA	ground based	LTA/LS-GP/JPB	8	7	1
15	MM	skyline	LTA/LS/JPB	130	13	10
16a	MM	skyline	LTA/LS/JPB	291	13	22
16b	MM	ground based	LTA/LS-GP/JPB	68	13	5
17	MM	skyline	LTA/LS/JPB	186	13	14
18a	EM-MM	skyline	LTA/LS/JPB	56	8	7
18b	EM-MM	skyline	LTA/LS/JPB	80	8	10
18c	EM-MM	skyline	LTA/LS/JPB	50	8	6
21b	MM	ground based	LTA/LS-GP/JPB	44	8	5
21c	MM	skyline	LTA/LS/JPB	101	8	13
21d	MM	ground based	LTA/LS-GP/JPB	101	8	13
21e	MM	skyline	LTA/LS/JPB	147	8	18
21f	MM	ground based	LTA/LS-GP/JPB	20	8	3
22a	EM-MM	ground based	LTA/LS-GP/JPB	223	7	32
22b	EM-MM	skyline	LTA/LS/JPB	36	7	5
23	PH	skyline	LTA/LS/JPB	69	4	17
25a	EM	ground based	LTA/LS-GP/JPB	117	11	11
25b	EM	skyline	LTA/LS/JPB	211	11	19
25c	EM	skyline	LTA/LS/JPB	20	11	2
26	EM	skyline	LTA/LS/JPB	169	11	15
27a	EM	skyline	LTA/LS/JPB	210	7	30
27b	EM	ground based	LTA/LS-GP/JPB	41	7	6
28	EA-MA	skyline	LTA/LS/JPB	348	11	32
29a	EM	ground based	LTA/LS-GP/JPB	25	6	4
29b	EM	skyline	LTA/LS/JPB	48	7	7
29c	EM	skyline	LTA/LS/JPB	391	7	56
29d	EM	helicopter	LTA/LS/HP	194	10	19
29e	EM	helicopter	NT	26	10	3
29f	EM	ground based	LTA/LS-GP/JPB	35	6	6
29g	EM	helicopter	NT	39	10	4
29h	EM	ground based	LTA/LS-GP/JPB	50	6	8
29i	EM	helicopter	NT	42	10	4
29j	EM	skyline	LTA/LS/JPB	37	7	5
29k	EM	skyline	LTA/LS/JPB	8	7	1
29l	EM	helicopter	LTA/LS/HP	75	10	8
29m	EM	helicopter	LTA/LS/HP	43	10	4
29n	EM	helicopter	LTA/LS/HP	19	10	2
30a	EM	ground based	LTA/LS-GP/JPB	75	4	19
30b	EM	ground based	LTA/LS-GP/JPB	4	4	1
31	EM	skyline	LTA/LS/JPB	187	8	23
32a	EM	skyline	LTA/LS/JPB	48	4	12
32b	EM	skyline	LTA/LS/JPB	352	4	88
32c	EM	ground based	LTA/LS-GP/JPB	16	4	4
32d	EM	ground based	LTA/LS-GP/JPB	29	4	7
32e	EM	skyline	LTA/LS/JPB	20	4	5
33	EM	ground based	LTA/LS-GP/JPB	42	4	10
34a	MA	ground based	LTA/LS-GP/JPB	40	12	3

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
34b	MA	skyline	LTA/LS/JPB	83	12	7
34c	MA	skyline	LTA/LS/JPB	84	12	7
35	MM, EM	ground based	LTA/LS-GP/JPB	16	4	4
36a	MM	ground based	LTA/LS-GP/JPB	272	16	17
36b	MM	skyline	LTA/LS/JPB	482	16	30
36c	MM	ground based	LTA/LS-GP/JPB	41	16	3
38a	EM	ground based	LTA/LS-GP/JPB	7	3	2
38b	EM	skyline	LTA/LS/JPB	8	4	2
39	EM	ground based	LTA/LS-GP/JPB	65	3	22
40a	MM, EH	ground based	LTA/LS-GP/JPB	43	7	6
40b	MM, EH	skyline	LTA/LS/JPB	113	7	16
40c	MM, EH	skyline	LTA/LS/JPB	122	7	17
40d	MM, EH	skyline	LTA/LS/JPB	34	7	5
41a	EA-MM	ground based	LTA/LS-GP/JPB	113	10	11
41b	EA-MM	skyline	LTA/LS/JPB	49	10	5
41c	EA-MM	skyline	LTA/LS/JPB	49	10	5
42c	MM	ground based	LTA/LS-GP/JPB	29	11	3
42d	MM	ground based	LTA/LS-GP/JPB	13	11	1
42e	MM	ground based	LTA/LS-GP/JPB	35	11	3
43a	MA	ground based	LTA/LS-GP/JPB	52	12	4
43b	MA	skyline	LTA/LS/JPB	222	12	19
43c	MA	skyline	LTA/LS/JPB	44	12	4
46	MA	ground based	LTA/LS-GP/JPB	42	8	5
51	MM	skyline	LTA/LS/JPB	48	9	5
52	MM	skyline	LTA/LS/JPB	21	8	3
53	MA	helicopter	NT	85	10	8
54	MM	skyline	LTA/LS/JPB	73	11	7
55a	EM	ground based	LTA/LS-GP/JPB	37	7	5
55b	EM	skyline	LTA/LS/JPB	20	7	3
57	EM	helicopter	LTA/LS/HP	334	11	30
59a	EM-MM	skyline	LTA/LS/JPB	238	16	15
59b	EM-MM	skyline	LTA/LS/JPB	185	16	12
59c	EM-MM	skyline	LTA/LS/JPB	104	16	7
59d	EM-MM	skyline	LTA/LS/JPB	49	16	3
60	MA	skyline	LTA/LS/JPB	72	8	9
61a	EM-MM	skyline	LTA/LS/JPB	93	11	8
61b	EM-MM	skyline	LTA/LS/JPB	45	11	4
63	EA	ground based	LTA/LS-GP/JPB	40	3	13
64a	MA	helicopter	LTA/LS/HP	606	12	51
64b	MA	helicopter	LTA/LS/HP	77	12	6
64c	MA	helicopter	LTA/LS/HP	80	12	7
64d	MA	helicopter	LTA/LS/HP	287	12	24
64f	MA	helicopter	LTA/LS/HP	36	12	3
65	EM-MH	ground based	LTA/LS-GP/JPB	205	13	16
66a	MH	ground based	LTA/LS-GP/JPB	279	16	17
66b	MH	skyline	LTA/LS/JPB	152	16	10
66c	MH	ground based	LTA/LS-GP/JPB	162	16	10

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
67a	EM-MM	skyline	LTA/LS/JPB	90	8	11
67b	EM-MM	skyline	LTA/LS/JPB	31	8	4
68	EM	skyline	LTA/LS/JPB	114	8	14
69	EH	ground based	LTA/LS-GP/JPB	24	6	4
70a	EM-MM	skyline	LTA/LS/JPB	319	11	29
70b	EM-MM	skyline	LTA/LS/JPB	169	11	15
71	EM	skyline	LTA/LS/JPB	104	9	12
72a	EM	skyline	LTA/LS/JPB	341	11	31
72b	EM	ground based	LTA/LS-GP/JPB	28	11	3
72c	EM	ground based	LTA/LS-GP/JPB	21	11	2
73	MA	skyline	LTA/LS/JPB	150	12	13
74a	MA	skyline	LTA/LS/JPB	210	12	17
74b	MA	skyline	LTA/LS/JPB	102	12	9
74c	MA	ground based	LTA/LS-GP/JPB	23	12	2
75b	EM-MM	helicopter	NT	83	11	8
75d	EM-MM	helicopter	NT	24	11	2
76b	MM	skyline	LTA/LS/JPB	16	11	1
76c	MM	helicopter	NT	76	11	7
76d	MM	helicopter	NT	19	11	2
78	MM	skyline	LTA/LS/JPB	104	8	13
80	MM	skyline	LTA/LS/JPB	186	10	19
81	EM, MM	skyline	LTA/LS/JPB	246	11	22
82	MA	skyline	LTA/LS/JPB	35	10	3
86	EM-MM	skyline	LTA/LS/JPB	161	11	15
87a	EM-MM	skyline	LTA/LS/JPB	245	13	19
87b	EM-MM	helicopter	NT	24	13	2
88b	EM	skyline	LTA/LS/JPB	18	11	2
91	MA	skyline	LTA/LS/JPB	32	7	5
92a	EM	helicopter	LTA/LS/HP	164	16	10
92b	EM	helicopter	LTA/LS/HP	68	16	4
92c	EM	helicopter	LTA/LS/HP	60	16	4
92d	EM	helicopter	LTA/LS/HP	62	16	4
93a	MA	helicopter	LTA/LS/HP	437	15	29
93b	MA	helicopter	LTA/LS/HP	663	15	44
93c	MA	helicopter	LTA/LS/HP	64	15	4
94	EM	ground based	LTA/LS-GP/JPB	62	9	7
95a	EM	skyline	LTA/LS/JPB	187	8	23
95b	EM	ground based	LTA/LS-GP/JPB	10	8	1
95c	EM	skyline	LTA/LS/JPB	24	8	3
95d	EM	skyline	LTA/LS/JPB	34	8	4
96a	EA	skyline	LTA/LS/JPB	26	7	4
96b	EA	skyline	LTA/LS/JPB	52	7	7
99a	MA	ground based	LTA/LS-GP/JPB	355	12	30
99b	MA	skyline	LTA/LS/JPB	434	12	36
99c	MA	helicopter	NT	302	12	25
100	EM-MM	skyline	LTA/LS/JPB	201	16	13
105	EM-MM	ground based	LTA/LS-GP/JPB	52	16	3

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
106	EM-MM	skyline	LTA/LS/JPB	83	16	5
102	MA	ground based	LTA/LS-GP/JPB	167	12	14
103	MM	skyline	LTA/LS/JPB	364	16	23
104	MM	skyline	LTA/LS/JPB	116	11	11
107a (901)	EA	ground based	LTA/LS-GP/JPB	113	7	16
107b (902)	EA	ground based	LTA/LS-GP/JPB	77	7	11
107c (903)	EA	ground based	LTA/LS-GP/JPB	95	7	14
108a (904)	MA	ground based	LTA/LS-GP/JPB	157	12	13
108b (905)	MA	ground based	LTA/LS-GP/JPB	155	12	13
Regeneration Treatment						
1b	EH	skyline	LTA/LS/JPB	378	35	11
2c	EM, MM	ground based	LTA/LS-GP/JPB	80	35	2
2d	EM, MM	skyline	LTA/LS/JPB	92	35	3
19a	EM-MM	skyline	LTA/LS/JPB	149	35	4
19b	EM-MM	ground based	LTA/LS-GP/JPB	25	35	1
20a	EH	ground based	LTA/LS-GP/JPB	447	35	13
20b	EH	skyline	LTA/LS/JPB	375	35	11
21a	MM	skyline	LTA/LS/JPB	594	35	17
21g	MM	skyline	LTA/LS/JPB	41	35	1
42a	MM	ground based	LTA/LS-GP/JPB	167	35	5
42b	MM	ground based	LTA/LS-GP/JPB	76	35	2
44a	EM	skyline	LTA/LS/JPB	244	35	7
44b	EM	skyline	LTA/LS/JPB	73	35	2
45	EM-MM	skyline	LTA/LS/JPB	599	35	17
62	EM-MM	skyline	LTA/LS/JPB	432	35	12
75a	EM-MM	helicopter	NT	285	35	8
75c	EM-MM	helicopter	NT	348	35	10
75d	EM-MM	helicopter	NT	125	35	4
75e	EM-MM	helicopter	NT	176	35	5
75f	EM-MM	helicopter	NT	19	35	1
76a	MM	skyline	LTA/LS/JPB	304	35	9
84	EM-MM	skyline	LTA/LS/JPB	99	35	3
85	EM-MM	ground based	LTA/LS-GP/JPB	869	35	25
88a	EM	skyline	LTA/LS/JPB	420	35	12
97	EM	ground based	LTA/LS-GP/JPB	297	35	8
98a	EM-MM	skyline	LTA/LS/JPB	64	35	2
98b	EM-MM	ground based	LTA/LS-GP/JPB	58	35	2
98c	EM-MM	skyline	LTA/LS/JPB	328	35	9
Totals				28,065		2,382

Table 68. Alternative 4 treatments by unit

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
1a	EH	skyline	LTA/LS/JPB	109	7	16
1b	EH	skyline	LTA/LS/JPB	91	7	13
1c	EH	ground based	LTA/LS-GP/JPB	185	7	26
1d	EH	skyline	LTA/LS/JPB	59	7	8
1e	EH	skyline	LTA/LS/JPB	63	7	9
2a	EM, MM	helicopter	LTA/LS/JPB	203	11	18
2b	EM, MM	ground based	LTA/LS-GP/JPB	64	11	6
2c	EM, MM	ground based	LTA/LS-GP/JPB	33	11	3
2d	EM, MM	skyline	LTA/LS/JPB	61	11	6
2e	EM, MM	ground based	LTA/LS-GP/JPB	12	11	1
3a	PH	helicopter	LTA	42	4	11
3b	PH	ground based	LTA/LS-GP/JPB	17	4	4
3c	PH	skyline	LTA/LS/JPB	16	4	4
4a	MA	ground based	LTA/LS-GP/JPB	45	10	5
4b	MA	ground based	LTA/LS-GP/JPB	38	10	4
7a	PH-EH	ground based	LTA/LS-GP/JPB	38	7	5
7b	PH-EH	skyline	LTA/LS/JPB	82	7	12
8a	EH, MM	skyline	LTA/LS/JPB	1143	8	143
8b	EH, MM	ground based	LTA/LS-GP/JPB	10	8	1
8c	EH, MM	skyline	LTA/LS/JPB	25	8	3
8d	EH, MM	helicopter	NT	43	8	5
8e	EH, MM	skyline	LTA/LS/JPB	68	8	9
8f	EH, MM	helicopter	NT	37	8	5
8g	EH, MM	helicopter	NT	71	8	9
9a	EH, MM	helicopter	LTA/LS/JPB	231	11	21
9b	EH, MM	helicopter	LTA/LS/JPB	67	11	6
9c	EH, MM	helicopter	LTA/LS-GP/JPB	131	11	12
9d	EH, MM	helicopter	LS/JPB	127	11	12
10	EA	ground based	LTA/LS-GP/JPB	225	6	37
11a	EM	skyline	LTA/LS/JPB	141	8	18
11b	EM	ground based	LTA/LS-GP/JPB	24	8	3
12	EM	ground based	LTA/LS-GP/JPB	90	3	30
14	MA	ground based	LTA/LS-GP/JPB	8	7	1
15	MM	skyline	LTA/LS/JPB	130	13	10
16a	MM	skyline	LTA/LS/JPB	291	13	22
16b	MM	ground based	LTA/LS-GP/JPB	68	13	5
17	MM	skyline	LTA/LS/JPB	186	13	14
18a	EM-MM	skyline	LTA/LS/JPB	56	8	7
18b	EM-MM	skyline	LTA/LS/JPB	80	8	10
18c	EM-MM	skyline	LTA/LS/JPB	50	8	6
19a	EM-MM	skyline	LTA/LS/JPB	55	8	7
19b	EM-MM	ground based	LTA/LS-GP/JPB	9	8	1
20a	EH	ground based	LTA/LS-GP/JPB	103	8	13
20b	EH	skyline	LTA/LS/JPB	100	8	13
21a	MM	skyline	LTA/LS/JPB	194	8	24
21b	MM	ground based	LTA/LS-GP/JPB	44	8	5

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
21c	MM	helicopter	LTA/LS/JPB	101	8	13
21d	MM	ground based	LTA/LS-GP/JPB	101	8	13
21e	MM	skyline	LTA/LS/JPB	147	8	18
21f	MM	ground based	LTA/LS-GP/JPB	20	8	3
21g	MM	skyline	LTA/LS/JPB	18	8	2
22a	EM-MM	ground based	LTA/LS-GP/JPB	223	7	32
22b	EM-MM	skyline	LTA/LS/JPB	36	7	5
23	PH	skyline	LTA/LS/JPB	69	4	17
25a	EM	ground based	LTA/LS-GP/JPB	117	11	11
25b	EM	skyline	LTA/LS/JPB	211	11	19
25c	EM	skyline	LTA/LS/JPB	20	11	2
26	EM	skyline	LTA/LS/JPB	169	11	15
27a	EM	skyline	LTA/LS/JPB	210	7	30
27b	EM	ground based	LTA/LS-GP/JPB	41	7	6
28	EA-MA	skyline	LTA/LS/JPB	348	11	32
29a	EM	ground based	LTA/LS-GP/JPB	25	6	4
29b	EM	helicopter	LTA/LS	48	7	7
29c	EM	helicopter	LTA/LS/JPB	391	7	56
29d	EM	helicopter	LTA/LS/HP	194	10	19
29e	EM	helicopter	NT	26	10	3
29f	EM	helicopter	LTA/LS-GP/JPB	35	6	6
29g	EM	helicopter	NT	39	10	4
29h	EM	helicopter	LTA/LS-GP/JPB	50	6	8
29i	EM	helicopter	NT	42	10	4
29j	EM	helicopter	LTA/LS/JPB	37	7	5
29k	EM	helicopter	LTA/LS/JPB	8	7	1
29l	EM	helicopter	LTA/LS/HP	75	10	8
29m	EM	helicopter	LTA/LS/HP	43	10	4
29n	EM	helicopter	LTA/LS/HP	19	10	2
30a	EM	ground based	LTA/LS-GP/JPB	75	4	19
30b	EM	ground based	LTA/LS-GP/JPB	4	4	1
31	EM	skyline	LTA/LS/JPB	187	8	23
32a	EM	skyline	LTA/LS/JPB	48	4	12
32b	EM	skyline	LTA/LS/JPB	352	4	88
32c	EM	ground based	LTA/LS-GP/JPB	16	4	4
32d	EM	ground based	LTA/LS-GP/JPB	29	4	7
32e	EM	skyline	LTA/LS/JPB	20	4	5
33	EM	ground based	LTA/LS-GP/JPB	42	4	10
34a	MA	ground based	LTA/LS-GP/JPB	40	12	3
34b	MA	helicopter	LTA/LS/JPB	83	12	7
34c	MA	skyline	LTA/LS/JPB	84	12	7
35	MM,EM	ground based	LTA/LS-GP/JPB	16	4	4
36a	MM	ground based	LTA/LS-GP/JPB	272	16	17
36b	MM	skyline-MS	LTA/LS/JPB	482	16	30
36c	MM	ground based	LTA/LS-GP/JPB	41	16	3
38a	EM	ground based	LTA/LS-GP/JPB	7	3	2
38b	EM	skyline	LTA/LS/JPB	8	4	2
39	EM	ground based	LTA/LS-GP/JPB	65	3	22

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
40a	MM, EH	ground based	LTA/LS-GP/JPB	43	7	6
40b	MM, EH	skyline	LTA/LS/JPB	113	7	16
40c	MM, EH	helicopter	LTA/LS/JPB	122	7	17
40d	MM, EH	skyline	LTA/LS/JPB	34	7	5
41a	EA-MM	ground based	LTA/LS-GP/JPB	113	10	11
41b	EA-MM	helicopter	LS/JPB	49	10	5
41c	EA-MM	helicopter	LS/JPB	49	10	5
42a	MM	ground based	LTA/LS-GP/JPB	93	11	8
42b	MM	ground based	LTA/LS-GP/JPB	66	11	6
42c	MM	ground based	LTA/LS-GP/JPB	29	11	3
42d	MM	ground based	LTA/LS-GP/JPB	13	11	1
42e	MM	ground based	LTA/LS-GP/JPB	35	11	3
43a	MA	ground based	LTA/LS-GP/JPB	52	12	4
43b	MA	helicopter	LTA/LS/JPB	164	12	14
43c	MA	skyline	LTA/LS/JPB	44	12	4
43d	MA	skyline	LTA/LS/JPB	59	12	5
44a	EM	skyline	LTA/LS/JPB	99	11	9
44b	EM	skyline	LTA/LS/JPB	35	11	3
45	EM-MM	skyline	LTA/LS/JPB	269	11	24
46	MA	ground based	LTA/LS-GP/JPB	42	8	5
51	MM	skyline	LTA/LS/JPB	48	9	5
52	MM	skyline	LTA/LS/JPB	21	8	3
53	MA	helicopter	NT	85	10	8
54	MM	skyline	LTA/LS/JPB	73	11	7
55a	EM	ground based	LTA/LS-GP/JPB	37	7	5
55b	EM	skyline	LTA/LS/JPB	20	7	3
57	EM	helicopter	LTA/LS/HP	334	11	30
59a	EM-MM	skyline	LTA/LS/JPB	238	16	15
59b	EM-MM	skyline	LTA/LS/JPB	185	16	12
59c	EM-MM	skyline	LTA/LS/JPB	104	16	7
59d	EM-MM	skyline	LTA/LS/JPB	49	16	3
60	MA	skyline	LTA/LS/JPB	72	8	9
61a	EM-MM	skyline	LTA/LS/JPB	93	11	8
61b	EM-MM	skyline	LTA/LS/JPB	45	11	4
62	EM-MM	skyline	LTA/LS/JPB	221	13	17
63	EA	ground based	LTA/LS-GP/JPB	40	3	13
64a	MA	helicopter	LTA/LS/HP	606	12	51
64b	MA	helicopter	LTA/LS/HP	77	12	6
64c	MA	helicopter	LTA/LS/HP	80	12	7
64d	MA	helicopter	LTA/LS/HP	287	12	24
64f	MA	helicopter	LTA/LS/HP	36	12	3
65	EM-MH	ground based	LTA/LS-GP/JPB	205	13	16
66a	MH	ground based	LTA/LS-GP/JPB	279	16	17
66b	MH	helicopter	LTA/LS/JPB	152	16	10
66c	MH	ground based	LTA/LS-GP/JPB	162	16	10
67a	EM-MM	skyline	LTA/LS/JPB	90	8	11
67b	EM-MM	skyline	LTA/LS/JPB	31	8	4
68	EM	skyline	LTA/LS/JPB	114	8	14

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
69	EH	ground based	LTA/LS-GP/JPB	24	6	4
70a	EM-MM	skyline	LTA/LS/JPB	319	11	29
70b	EM-MM	helicopter	LTA/LS/JPB	139	11	13
70c	EM-MM	skyline	LTA/LS/JPB	30	11	3
71	EM	skyline	LTA/LS/JPB	104	9	12
72a	EM	skyline	LTA/LS/JPB	123	11	11
72b	EM	ground based	LTA/LS-GP/JPB	28	11	3
72c	EM	ground based	LTA/LS-GP/JPB	21	11	2
72d	EM	helicopter	LTA/LS/JPB	166	11	15
72e	EM	skyline	LTA/LS/JPB	51	11	5
73	MA	skyline	LTA/LS/JPB	150	12	13
74a	MA	skyline	LTA/LS/JPB	210	12	17
74b	MA	skyline	LTA/LS/JPB	102	12	9
74c	MA	ground based	LTA/LS-GP/JPB	23	12	2
75a	EM-MM	helicopter	NT	355	11	32
75b	EM-MM	helicopter	NT	83	11	8
75c	EM-MM	helicopter	NT	289	11	26
75d	EM-MM	helicopter	NT	24	11	2
76a	MM	helicopter	LTA/LS/JPB	99	11	9
76b	MM	helicopter	NT	16	11	1
76c	MM	helicopter	NT	76	11	7
76d	MM	helicopter	NT	19	11	2
78	MM	skyline	LTA/LS/JPB	104	8	13
80a	MM	skyline	LTA/LS/JPB	156	10	16
80b	MM	helicopter	LTA/LS/JPB	30	10	3
81	EM, MM	helicopter	LTA/LS/JPB	246	11	22
82	MA	skyline	LTA/LS/JPB	35	10	3
84	EM-MM	helicopter	NT	62	13	5
85	EM-MM	ground based	LTA/LS-GP/JPB	299	11	27
86	EM-MM	skyline	LTA/LS/JPB	161	11	15
87a	EM-MM	helicopter	LTA/LS/JPB	283	15	19
87b	EM-MM	helicopter	NT	24	13	2
88a	EM	skyline	LTA/LS/JPB	191	11	17
88b	EM	skyline	LTA/LS/JPB	18	11	2
91	MA	skyline	LTA/LS/JPB	32	7	5
92a	EM	helicopter	LTA/LS/HP	164	16	10
92b	EM	helicopter	LTA/LS/HP	68	16	4
92c	EM	helicopter	LTA/LS/HP	60	16	4
92d	EM	helicopter	LTA/LS/HP	62	16	4
93a	MA	helicopter	LTA/LS/HP	437	15	29
93b	MA	helicopter	LTA/LS/HP	663	15	44
93c	MA	helicopter	LTA/LS/HP	64	15	4
94	EM	ground based	LTA/LS-GP/JPB	62	9	7
95a	EM	helicopter	LTA/LS/JPB	187	8	23
95b	EM	ground based	LTA/LS-GP/JPB	10	8	1
95c	EM	skyline	LTA/LS/JPB	24	8	3
95d	EM	skyline	LTA/LS/JPB	34	8	4
96a	EA	skyline	LTA/LS/JPB	26	7	4

Unit	Seral Stage	Logging System	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
96b	EA	helicopter	LTA/LS/JPB	52	7	7
97	EM	ground based	LTA/LS-GP/JPB	76	8	9
98a	EM-MM	skyline	LTA/LS/JPB	246	16	15
98b	EM-MM	ground based	LTA/LS-GP/JPB	26	16	2
99a	MA	ground based	LTA/LS-GP/JPB	355	12	30
99b	MA	helicopter	LTA/LS/JPB	434	12	36
99c	MA	helicopter	NT	302	12	25
100	EM-MM	helicopter	LTA/LS/HP	110	16	7
100	EM-MM	skyline	LTA/LS/JPB	91	16	6
105	EM-MM	ground based	LTA/LS-GP/JPB	52	16	3
106	EM-MM	helicopter	LTA/LS/HP	83	16	5
102	MA	ground based	LTA/LS-GP/JPB	167	12	14
103	MM	skyline	LTA/LS/JPB	364	16	23
104	MM	helicopter	LTA/LS/JPB	74	11	7
104	MM	skyline	LTA/LS/JPB	16	11	1
104	MM	skyline	LTA/LS/JPB	27	11	2
107a (901)	EA	ground based	LTA/LS-GP/JPB	113	7	16
107b (902)	EA	ground based	LTA/LS-GP/JPB	77	7	11
107c (903)	EA	ground based	LTA/LS-GP/JPB	95	7	14
108a (904)	MA	ground based	LTA/LS-GP/JPB	157	12	13
108b (905)	MA	ground based	LTA/LS-GP/JPB	155	12	13
Totals				24,034		2,471

Table 69. Alternative 5 treatments by unit

Unit	Seral Stage	Logging Systems	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
1a	EH	skyline	LTA/LS/JPB	109	7	16
1b	EH	skyline	LTA/LS/JPB	91	7	13
1c	EH	ground based	LTA/LS-GP/JPB	185	7	26
1d	EH	skyline	LTA/LS/JPB	59	7	8
1e	EH	skyline	LTA/LS/JPB	63	7	9
2a	EM, MM	skyline	LTA/LS/JPB	203	11	18
2b	EM, MM	ground based	LTA/LS-GP/JPB	64	11	6
2c	EM, MM	ground based	LTA/LS-GP/JPB	33	11	3
2d	EM, MM	skyline	LTA/LS/JPB	61	11	6
2e	EM, MM	ground based	LTA/LS-GP/JPB	12	11	1
3a	PH	skyline	LTA/LS/JPB	42	4	11
3b	PH	ground based	LTA/LS-GP/JPB	17	4	4
3c	PH	skyline	LTA/LS/JPB	16	4	4
4a	MA	ground based	LTA/LS-GP/JPB	45	10	5
4b	MA	ground based	LTA/LS-GP/JPB	38	10	4
7a	PH-EH	ground based	LTA/LS-GP/JPB	38	7	5
7b	PH-EH	skyline	LTA/LS/JPB	82	7	12
8a	EH, MM	skyline	LTA/LS/JPB	1252	8	156
8b	EH, MM	ground based	LTA/LS-GP/JPB	10	8	1
8c	EH, MM	skyline	LTA/LS/JPB	25	8	3
8d	EH, MM	helicopter	NT	43	8	5
8e	EH, MM	skyline	LTA/LS/JPB	68	8	9
9a	EH, MM	skyline	LTA/LS/JPB	231	11	21
9b	EH, MM	skyline	LTA/LS/JPB	67	11	6
9c	EH, MM	ground based	LTA/LS-GP/JPB	131	11	12
9d	EH, MM	helicopter	LS/JPB	127	11	12
10	EA	ground based	LTA/LS-GP/JPB	225	6	37
11a	EM	skyline	LTA/LS/JPB	141	8	18
11b	EM	ground based	LTA/LS-GP/JPB	24	8	3
12	EM	ground based	LTA/LS-GP/JPB	90	3	30
14	MA	ground based	LTA/LS-GP/JPB	8	7	1
15	MM	skyline	LTA/LS/JPB	130	13	10
16a	MM	skyline	LTA/LS/JPB	291	13	22
16b	MM	ground based	LTA/LS-GP/JPB	68	13	5
17	MM	skyline	LTA/LS/JPB	186	13	14
18a	EM-MM	skyline	LTA/LS/JPB	56	8	7
18b	EM-MM	skyline	LTA/LS/JPB	80	8	10
18c	EM-MM	skyline	LTA/LS/JPB	50	8	6
19a	EM-MM	skyline	LTA/LS/JPB	55	8	7
19b	EM-MM	ground based	LTA/LS-GP/JPB	9	8	1
20a	EH	ground based	LTA/LS-GP/JPB	103	8	13
20b	EH	skyline	LTA/LS/JPB	100	8	13
21a	MM	skyline	LTA/LS/JPB	194	8	24
21b	MM	ground based	LTA/LS-GP/JPB	44	8	5
21c	MM	skyline	LTA/LS/JPB	101	8	13

Unit	Seral Stage	Logging Systems	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
21d	MM	ground based	LTA/LS-GP/JPB	101	8	13
21e	MM	skyline	LTA/LS/JPB	147	8	18
21f	MM	ground based	LTA/LS-GP/JPB	20	8	3
21g	MM	skyline	LTA/LS/JPB	18	8	2
22a	EM-MM	ground based	LTA/LS-GP/JPB	223	7	32
22b	EM-MM	skyline	LTA/LS/JPB	36	7	5
23	PH	skyline	LTA/LS/JPB	69	4	17
25a	EM	ground based	LTA/LS-GP/JPB	117	11	11
25b	EM	skyline	LTA/LS/JPB	211	11	19
25c	EM	skyline	LTA/LS/JPB	20	11	2
26	EM	skyline	LTA/LS/JPB	169	11	15
27a	EM	skyline	LTA/LS/JPB	210	7	30
27b	EM	ground based	LTA/LS-GP/JPB	41	7	6
28	EA-MA	skyline	LTA/LS/JPB	348	11	32
29a	EM	ground based	LTA/LS-GP/JPB	25	6	4
29b	EM	skyline	LTA/LS/JPB	48	7	7
29c	EM	skyline	LTA/LS/JPB	391	7	56
29d	EM	helicopter	LTA/LS/HP	194	10	19
29e	EM	helicopter	NT	26	10	3
29f	EM	ground based	LTA/LS-GP/JPB	35	6	6
29g	EM	helicopter	NT	39	10	4
29h	EM	ground based	LTA/LS-GP/JPB	50	6	8
29i	EM	helicopter	NT	42	10	4
29j	EM	skyline	LTA/LS/JPB	37	7	5
29k	EM	skyline	LTA/LS/JPB	8	7	1
29l	EM	helicopter	LTA/LS/HP	75	10	8
29m	EM	helicopter	LTA/LS/HP	43	10	4
29n	EM	helicopter	LTA/LS/HP	19	10	2
30a	EM	ground based	LTA/LS-GP/JPB	75	4	19
30b	EM	ground based	LTA/LS-GP/JPB	4	4	1
31	EM	skyline	LTA/LS/JPB	187	8	23
32a	EM	skyline	LTA/LS/JPB	48	4	12
32b	EM	skyline	LTA/LS/JPB	352	4	88
32c	EM	ground based	LTA/LS-GP/JPB	16	4	4
32d	EM	ground based	LTA/LS-GP/JPB	29	4	7
32e	EM	skyline	LTA/LS/JPB	20	4	5
33	EM	ground based	LTA/LS-GP/JPB	42	4	10
34a	MA	ground based	LTA/LS-GP/JPB	40	12	3
34b	MA	skyline	LTA/LS/JPB	83	12	7
34c	MA	skyline	LTA/LS/JPB	84	12	7
35	MM, EM	ground based	LTA/LS-GP/JPB	16	4	4
36a	MM	ground based	LTA/LS-GP/JPB	272	16	17
36b	MM	skyline	LTA/LS/JPB	482	16	30
36c	MM	ground based	LTA/LS-GP/JPB	41	16	3
38a	EM	ground based	LTA/LS-GP/JPB	7	3	2
38b	EM	skyline	LTA/LS/JPB	8	4	2
39	EM	ground based	LTA/LS-GP/JPB	65	3	22

Unit	Seral Stage	Logging Systems	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
41c	EA-MM	skyline	LTA/LS/JPB	49	10	5
40a	MM, EH	ground based	LTA/LS-GP/JPB	43	7	6
40b	MM, EH	skyline	LTA/LS/JPB	113	7	16
40c	MM, EH	skyline	LTA/LS/JPB	122	7	17
40d	MM, EH	skyline	LTA/LS/JPB	34	7	5
41a	EA-MM	ground based	LTA/LS-GP/JPB	113	10	11
41b	EA-MM	skyline	LTA/LS/JPB	49	10	5
42a	MM	ground based	LTA/LS-GP/JPB	93	11	8
42b	MM	ground based	LTA/LS-GP/JPB	66	11	6
42c	MM	ground based	LTA/LS-GP/JPB	29	11	3
42d	MM	ground based	LTA/LS-GP/JPB	13	11	1
42e	MM	ground based	LTA/LS-GP/JPB	35	11	3
43a	MA	ground based	LTA/LS-GP/JPB	52	12	4
43b	MA	skyline	LTA/LS/JPB	222	12	19
43c	MA	skyline	LTA/LS/JPB	44	12	4
44a	EM	skyline	LTA/LS/JPB	99	11	9
44b	EM	skyline	LTA/LS/JPB	35	11	3
45	EM-MM	skyline	LTA/LS/JPB	269	11	24
46	MA	ground based	LTA/LS-GP/JPB	42	8	5
51	MM	skyline	LTA/LS/JPB	48	9	5
52	MM	skyline	LTA/LS/JPB	21	8	3
53	MA	helicopter	NT	85	10	8
54	MM	skyline	LTA/LS/JPB	73	11	7
55a	EM	ground based	LTA/LS-GP/JPB	37	7	5
55b	EM	skyline	LTA/LS/JPB	20	7	3
57	EM	helicopter	LTA/LS/HP	334	11	30
59a	EM-MM	skyline	LTA/LS/JPB	238	16	15
59b	EM-MM	skyline	LTA/LS/JPB	185	16	12
59c	EM-MM	skyline	LTA/LS/JPB	104	16	7
59d	EM-MM	skyline	LTA/LS/JPB	49	16	3
60	MA	skyline	LTA/LS/JPB	72	8	9
61a	EM-MM	skyline	LTA/LS/JPB	93	11	8
61b	EM-MM	skyline	LTA/LS/JPB	45	11	4
62	EM-MM	skyline	LTA/LS/JPB	221	13	17
63	EA	ground based	LTA/LS-GP/JPB	40	3	13
64a	MA	helicopter	LTA/LS/HP	606	12	51
64b	MA	helicopter	LTA/LS/HP	77	12	6
64c	MA	helicopter	LTA/LS/HP	80	12	7
64d	MA	helicopter	LTA/LS/HP	287	12	24
64f	MA	helicopter	LTA/LS/HP	36	12	3
65	EM-MH	ground based	LTA/LS-GP/JPB	205	13	16
66a	MH	ground based	LTA/LS-GP/JPB	279	16	17
66b	MH	skyline	LTA/LS/JPB	152	16	10
66c	MH	ground based	LTA/LS-GP/JPB	162	16	10
67a	EM-MM	skyline	LTA/LS/JPB	90	8	11
67b	EM-MM	skyline	LTA/LS/JPB	31	8	4
68	EM	skyline	LTA/LS/JPB	114	8	14

Unit	Seral Stage	Logging Systems	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
69	EH	ground based	LTA/LS-GP/JPB	24	6	4
70a	EM-MM	skyline	LTA/LS/JPB	319	11	29
70b	EM-MM	skyline	LTA/LS/JPB	169	11	15
71	EM	skyline	LTA/LS/JPB	104	9	12
72a	EM	skyline	LTA/LS/JPB	341	11	31
72b	EM	ground based	LTA/LS-GP/JPB	28	11	3
72c	EM	ground based	LTA/LS-GP/JPB	21	11	2
73	MA	skyline	LTA/LS/JPB	150	12	13
74a	MA	skyline	LTA/LS/JPB	210	12	17
74b	MA	skyline	LTA/LS/JPB	102	12	9
74c	MA	ground based	LTA/LS-GP/JPB	23	12	2
75a	EM-MM	helicopter	NT	355	11	32
75b	EM-MM	helicopter	NT	83	11	8
75c	EM-MM	helicopter	NT	289	11	26
75d	EM-MM	helicopter	NT	24	11	2
76a	MM	skyline	LTA/LS/JPB	99	11	9
76b	MM	skyline	LTA/LS/JPB	16	11	1
76c	MM	helicopter	NT	76	11	7
76d	MM	helicopter	NT	19	11	2
78	MM	skyline	LTA/LS/JPB	104	8	13
80	MM	skyline	LTA/LS/JPB	186	10	19
81	EM, MM	skyline	LTA/LS/JPB	246	11	22
82	MA	skyline	LTA/LS/JPB	35	10	3
84	EM-MM	skyline	LTA/LS/JPB	62	13	5
85	EM-MM	ground based	LTA/LS-GP/JPB	299	11	27
86	EM-MM	skyline	LTA/LS/JPB	161	11	15
87a	EM-MM	skyline	LTA/LS/JPB	283	15	19
87b	EM-MM	helicopter	NT	24	13	2
88a	EM	skyline	LTA/LS/JPB	191	11	17
88b	EM	skyline	LTA/LS/JPB	18	11	2
91	MA	skyline	LTA/LS/JPB	32	7	5
92a	EM	helicopter	LTA/LS/HP	164	16	10
92b	EM	helicopter	LTA/LS/HP	68	16	4
92c	EM	helicopter	LTA/LS/HP	60	16	4
92d	EM	helicopter	LTA/LS/HP	62	16	4
93a	MA	Helicopter	LTA/LS/HP	437	15	29
93b	MA	helicopter	LTA/LS/HP	663	15	44
93c	MA	helicopter	LTA/LS/HP	64	15	4
94	EM	ground based	LTA/LS-GP/JPB	62	9	7
95a	EM	skyline	LTA/LS/JPB	187	8	23
95b	EM	ground based	LTA/LS-GP/JPB	10	8	1
95c	EM	skyline	LTA/LS/JPB	24	8	3
95d	EM	skyline	LTA/LS/JPB	34	8	4
96a	EA	skyline	LTA/LS/JPB	26	7	4
96b	EA	skyline	LTA/LS/JPB	52	7	7
97	EM	ground based	LTA/LS-GP/JPB	76	8	9
98a	EM-MM	skyline	LTA/LS/JPB	246	16	15

Unit	Seral Stage	Logging Systems	Fuels Treatments	Total Volume (MBF/acre)	Total Volume Removed (MBF/acre)	Acres
98b	EM-MM	ground based	LTA/LS-GP/JPB	26	16	2
99a	MA	ground based	LTA/LS-GP/JPB	355	12	30
99b	MA	skyline	LTA/LS/JPB	434	12	36
99c	MA	helicopter	NT	302	12	25
100	EM-MM	skyline	LTA/LS/JPB	201	16	13
105	EM-MM	ground based	LTA/LS-GP/JPB	52	16	3
106	EM-MM	skyline	LTA/LS/JPB	83	16	5
102	MA	ground based	LTA/LS-GP/JPB	167	12	14
103	MM	skyline	LTA/LS/JPB	364	16	23
104	MM	skyline	LTA/LS/JPB	116	11	11
107a (990)	EA	ground based	LTA/LS-GP/JPB	113	7	16
107b (991)	EA	ground based	LTA/LS-GP/JPB	77	7	11
107c (992)	EA	ground based	LTA/LS-GP/JPB	95	7	14
108a (993)	MA	ground based	LTA/LS-GP/JPB	157	12	13
108b (994)	MA	ground based	LTA/LS-GP/JPB	155	12	13
Totals				24,034		2,471

Appendix B – Acronyms and Glossary

List of Acronyms

ACS – Aquatic Conservation Strategy
ASQ – Allowable Sale Quantity
BA – Biological Assessment
BBS – Breeding Bird Survey
BE – Biological Evaluation
BLM – Bureau of Land Management
BMP – Best Management Practice
CEQ – Council on Environmental Quality
CFR – Code of Federal Regulations
CWD – Coarse Woody Debris
CWE – Cumulative Watershed Effects
DBH – Diameter at Breast Height
DFG – Department of Fish and Game
DEIS – Draft Environmental Impact Statement
EIS – Environmental Impact Statement
EPA – Environmental Protection Agency
ERA – Equivalent Roaded Acres
ESA – Endangered Species Act
FEIS – Final Environmental Impact Statement
FEMAT -- Forest Ecosystem Management Assessment Team
FS – Forest Service
FSH – Forest Service Handbook
FSM – Forest Service Manual
FWS – Fish and Wildlife Service
GIS – Geographic Information System
HRV – Historic Range of Variability
HUC – Hydrologic Unit Code
LOP – Limited Operating Period
LRMP – Land and Resource Management Plan
LSR – Late-successional Reserve
MBF – Thousand Board Feet
MIS – Management Indicator Species
MMBF – Million Board Feet
NEPA – National Environmental Policy Act
NFMA – National Forest Management Act

NFP – Northwest Forest Plan
NFS – National Forest System
NMFS – National Marine Fisheries Service
NOA – Notice of Availability
NOI – Notice of Intent
N/R – Nesting and Roosting
NTMB – Neotropical Migratory Bird
PNV – Present Net Value
RD – Relative Density
RMR – Recommended Management Range
ROD – Record of Decision
ROS – Recreational Opportunity Spectrum
S&G – Standards and Guidelines
SOPA – Schedule of Proposed Actions
SRNF – Six Rivers National Forest
TOC – Threshold of Concern
USDA – United States Department of Agriculture
USDI – United States Department of the Interior
VQO – Visual Quality Objectives
WA – Watershed Analysis

Glossary

Analysis Area – project area plus lands adjacent to it, which make up the land base considered by resource specialists in analyzing impacts of past, present, and reasonably foreseeable future actions in conjunction with the proposed alternatives. Analysis areas vary in size for different resource areas.

Aquatic Conservation Strategy (ACS) – a strategy designed to assist in the recovery of anadromous fish stocks at risk that is part of the Northwest Forest Plan. The ACS consists of four components that are designed to operate together to maintain and restore the productivity and resiliency of riparian and riparian-dependent ecosystems. The components include riparian reserves, key watersheds, watershed analysis, and watershed restoration.

Best Management Practices (BMPs) – project-level practices used for water quality management on the National Forest System lands within the State of California; see Appendix D for those BMP's that apply to this project.

Canopy Cover and Canopy Closure – the degree to which the canopy or the branches and foliage of a tree blocks sunlight or obscure the sky. More precisely, the ground area covered by tree crowns. Canopy cover is expressed as a percent of ground area.

California Wildlife Habitat Relationships – a system developed jointly by Region 5 of the Forest Service and the California Department of Fish and Game that classifies forest stands by

dominant species types, tree sizes, and tree densities and rates the resulting classes in regard to habitat value for various wildlife species or guilds.

Cumulative Impact – the impact on the environment that results from the incremental impact of the action when added to the past, present, and foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Decommissioning – the practice of closing a road to mechanical use and returning the road to a natural or semi-natural condition. Decommissioning could include complete obliteration of the road prism (i.e. replacing fills into cuts and grading to match the natural topography) or more limited work including removing stream-crossing fills and structures (i.e. culverts) and shaping the abandoned road surface (e.g. constructing in-road water bars). In both cases, it may involve mulching the surface with woody debris and/or planting erosion-control grasses.

Diameter at Breast Height (DBH) – the diameter of a tree measured at 4.5 feet above the ground on the uphill side.

Endangered Species – plant or animal species that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of Interior in accordance with the Endangered Species Act of 1973.

Environmental Analysis – analysis of a proposed federal action and alternative actions and their predictable environmental effects, incorporating physical, biological, and socio-economic considerations.

Environmental Impact Statement (EIS) – a statement of the environmental effects of a proposed action and alternatives to it. It is required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA) and released to the public and other agencies for comment and review.

Fireline – a corridor that has been cleared of organic material to expose mineral soil. Firelines may be constructed by hand or by mechanical equipment (e.g. dozers). Hand firelines are created by forest workers using shovels and hand tools to remove organic materials and expose mineral soil. The line width generally ranges from 2 to 3 feet, depending on the fuel loading.

Historic Range of Variability (HRV) – the historic spectrum of conditions possible in ecosystem composition, structure, and function considering temporal, spatial, and environmental factors. The LRMP assigns this parameter to vegetation by series and seral stage classes at the Forest zone scale.

Issue – a point of discussion, debate, or dispute about environmental effects of the proposed action.

Landing – an area within the forest cleared of vegetation and graded level used to stockpile logs (create a *log deck*) and eventually to load log trucks for hauling to a mill.

Late-successional Forest – habitat that occurs in late-successional stands that are defined as “forest seral stages which include both mature and old-growth age classes”.

Late-Successional Reserve (LSR) – one of 17 LRMP management areas (Management Area 8 – Special Habitat) that is intended to provide a core of relatively natural, undisturbed habitat for plants and animals associated with mature and old-growth forests (see LRMP, p. IV-34).

Live Crown Ratio – proportion of a tree's bole occupied by branches with live needles or leaves, expressed as a percentage of the tree's total height.

Mainstem – the principle, largest or dominating stream or channel of any given area or drainage system.

Management Indicator Species (MIS) – species whose populations are believed to respond to management activities chosen to represent conditions of specific habitat types. They are selected by each National Forest (see LRMP, p. IV-96).

Partial Retention – visual quality objective of providing a near-natural-appearing landscape, where management activities may be evident but must remain visually subordinate to the characteristic landscape.

Piles or Burn Piles – piling harvest or thinning residues (branches and limbs, or *slash*) and burning when moisture content has been reduced through evaporation, wildfire hazard is low, and atmospheric conditions are favorable for dispersal of smoke.

Planning Area – a predetermined area that encompasses a project area opportunity.

Project Area – the land base within a planning area where the connected actions associated with the project alternative take place, i.e., harvest units, haul routes, drafting sources, etc.

Project Design Features – parameters and requirements built into the design of a project to reduce, minimize, or eliminate impacts to various natural and human resources in order to ensure project compliance with the resource protection standards and guidelines of the LRMP. These features include Best Management Practices (BMPs).

Recommended Management Range (RMR) – a recommended range of environmental conditions that is expected to maintain ecosystem process and function; usually a subset of the historic range of variability (HRV). The LRMP assigns this parameter to vegetation by series and seral stage classes at the Forest zone scale.

Record of Decision (ROD) – a document separate from, but associated with, an environmental impact statement that: 1) states the management decision; 2) states the reason for that decision; 3) identifies all alternatives including the environmentally preferable and selected alternatives; and 4) states whether all practicable measures to avoid environmental harm from the selected alternative have been adopted, and if not, why.

Regeneration Harvest (Cutting) – a silvicultural treatment that removes nearly all trees in mature stands for the sake of establishing new stands. Regeneration harvest with legacy and shelterwood cutting are examples of even-aged regeneration harvest treatments considered in this project.

Retention – visual quality objective of providing a natural-appearing landscape where management activities are not visually evident to the casual forest visitor.

Riparian Reserves – one of 17 management areas under the LRMP; established by the Forest Service to give special management considerations to protect the integrity of ecosystems bordering bodies of water and wetlands for riparian and aquatic-dependent species.

Recreation Opportunity Spectrum (ROS) -- The Recreation Opportunity Spectrum (ROS) is a system for classifying and managing recreation opportunities based on the following criteria: physical setting, social setting, and managerial setting. The combination of the three criteria results in six different ROS classes, which are primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban.

Schedule of Proposed Actions (SOPA) – a notice of potential FS actions on each National Forest distributed quarterly to parties who have requested it. Contact the SRNF's planning staff officer to be included on the distribution list or visit the website at: http://www.fs.fed.us/r5/sixrivers/project/ea/sopa/.

Sensitive Species – species listed as such by the Regional Forester of the FS Pacific Southwest Region because their populations are such that FS management actions could contribute to a trend toward eventual listing by FWS/NMFS as threatened or endangered species.

Seral Stage – the stage in the successional development of an ecosystem; an ecological stage, usually identified by vegetation types.

Significant Issue – a point of discussion, debate, or dispute about environmental effects that are within the scope of a proposed action; is relevant, not already decided by law, regulation, LRMP, or other higher level decision; and is supported by scientific evidence. This issue type generally forms the basis for the development of alternatives to the proposed action.

Silviculture – the science and practice of manipulating vegetation in forest stands to meet management goals and objectives.

Site-Potential Tree – a tree that has attained the average maximum height possible given site conditions where it occurs. The measured height of a site-potential tree is used to determine timber production potential of a site and used to define the width of riparian reserves under the interim riparian reserve designation rules of the LRMP.

Skid Trails – off-road routes taken by tractors to access felled trees and to drag them to log landings.

Slash – residue from timber harvest or thinning; limbs, branches, and damaged small trees.

Snag – a dead standing tree.

Stocking – the number of trees per acre.

System Road – National Forest System roads that are considered part of the FS transportation network and are maintained to certain standards for identified purposes. Non-system roads are other existing roads that are not maintained by the FS because they are not needed for a public purpose.

Threatened Species – plant or animal species likely to become endangered throughout all or a specific portion of tits range within the foreseeable future, as designated by the USDI Fish and Wildlife Service under the Endangered Species Act of 1973.

Visual Quality Objective (VQO) – management objective for scenic quality based on physical and sociological characteristics of an area that establishes the maximum level of future alteration to an area's landscape.

Yarding Unutilized Material (YUM) – translocation of unutilized material during logging operations from the unit to the landing for future disposal via pile burning or biomass/firewood utilization by the public.

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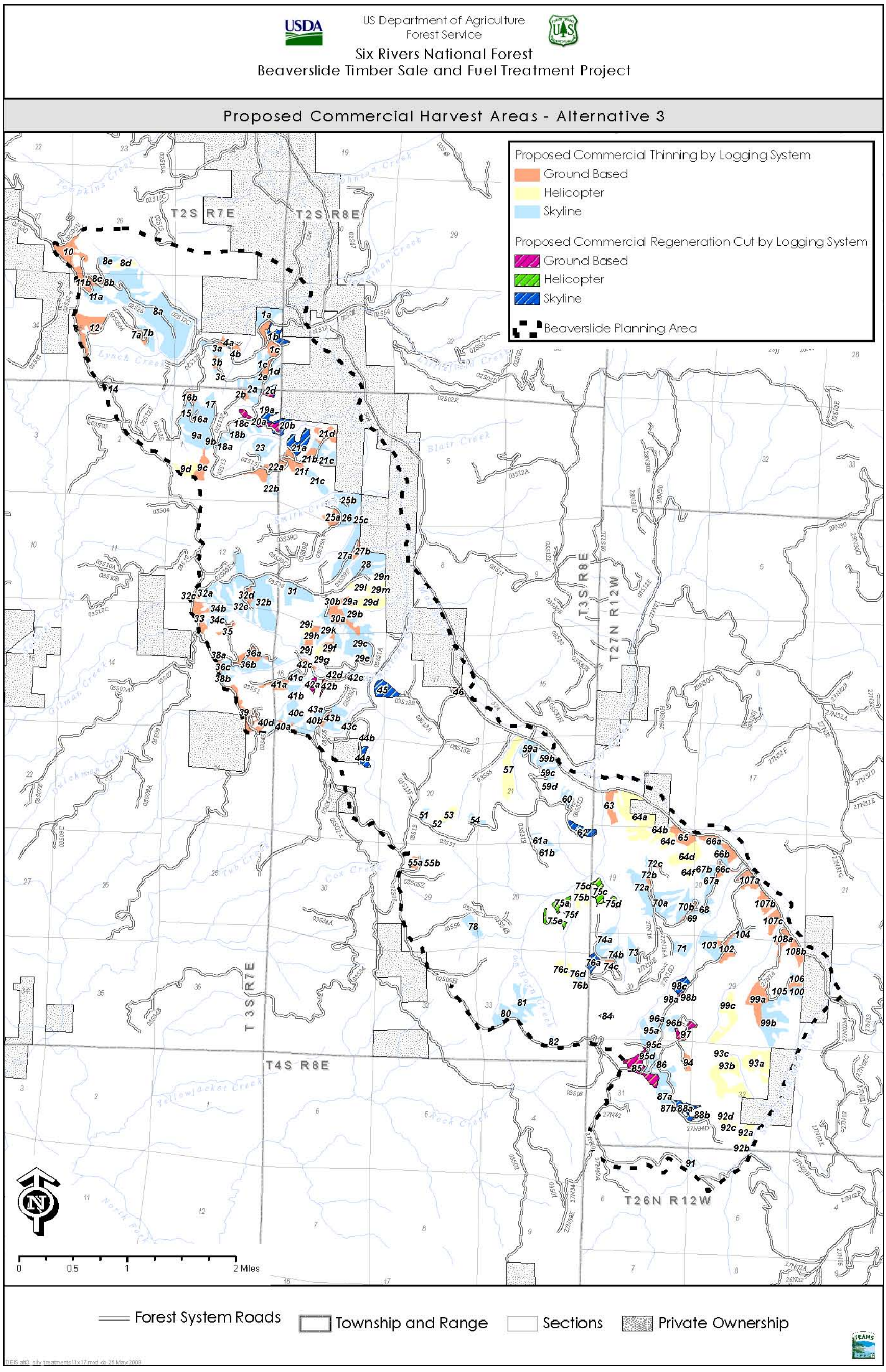
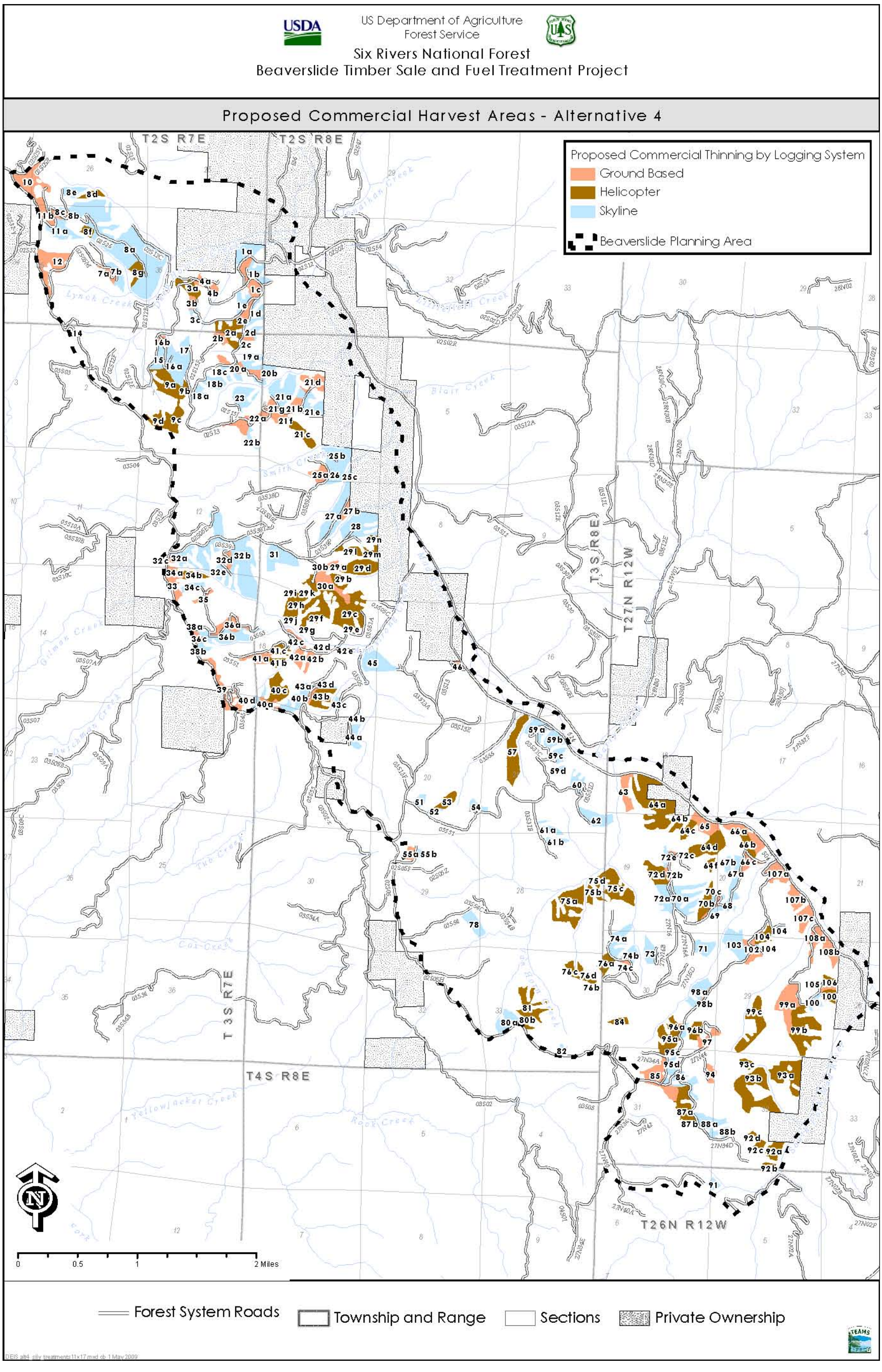
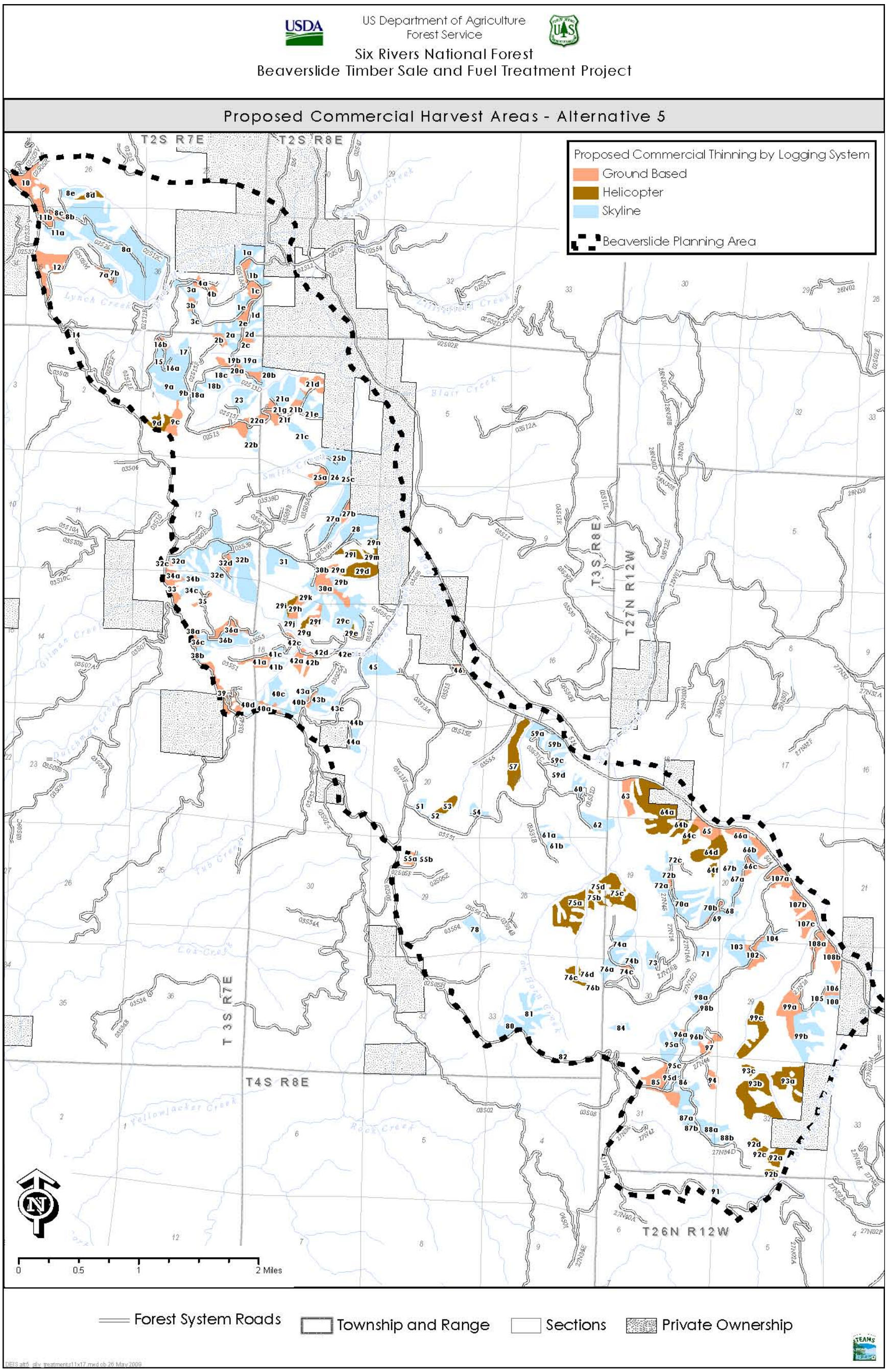
Maps



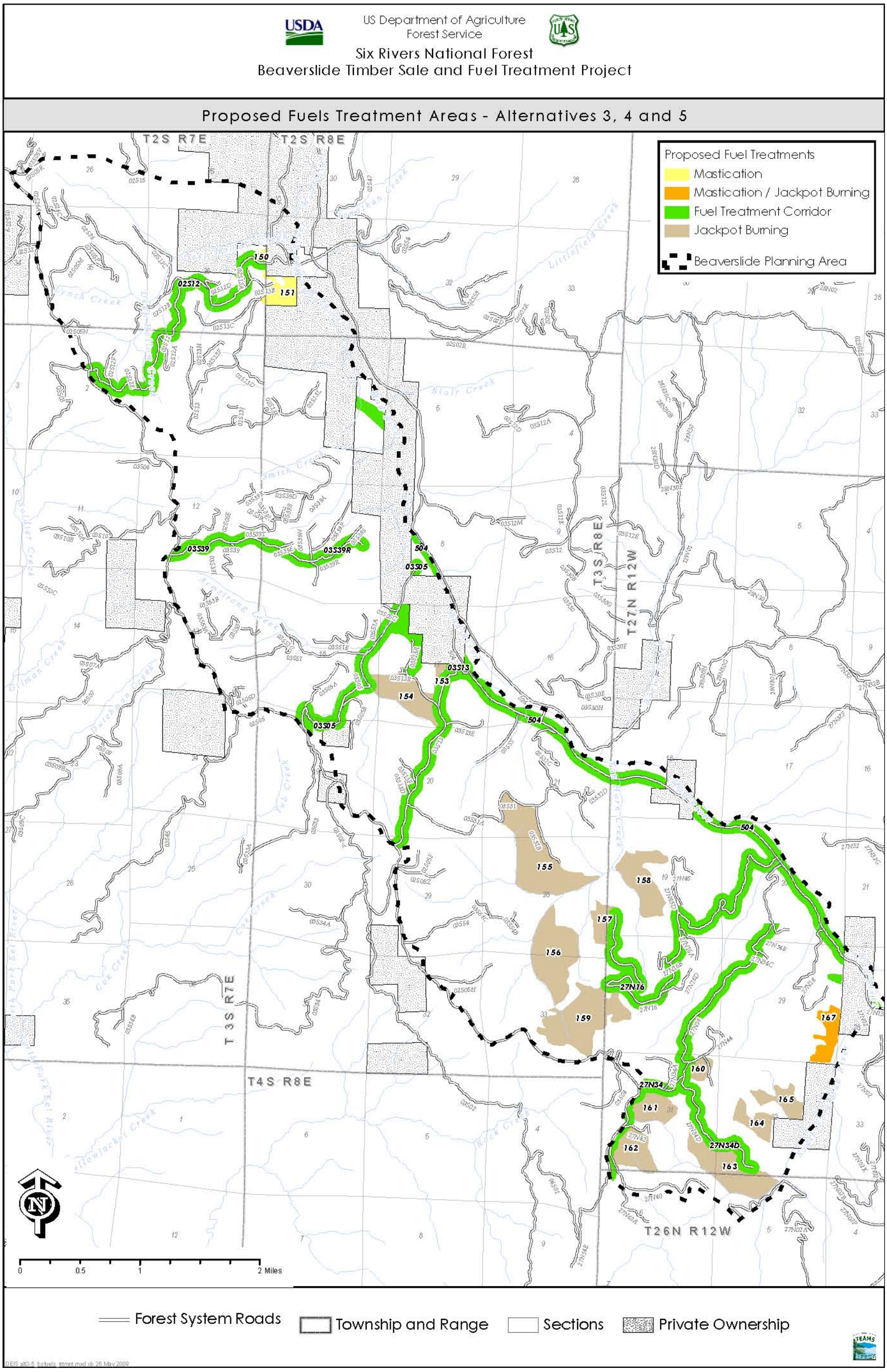
Map 1. Proposed commercial thinning units, regeneration harvest areas, and logging systems in Alternative 3



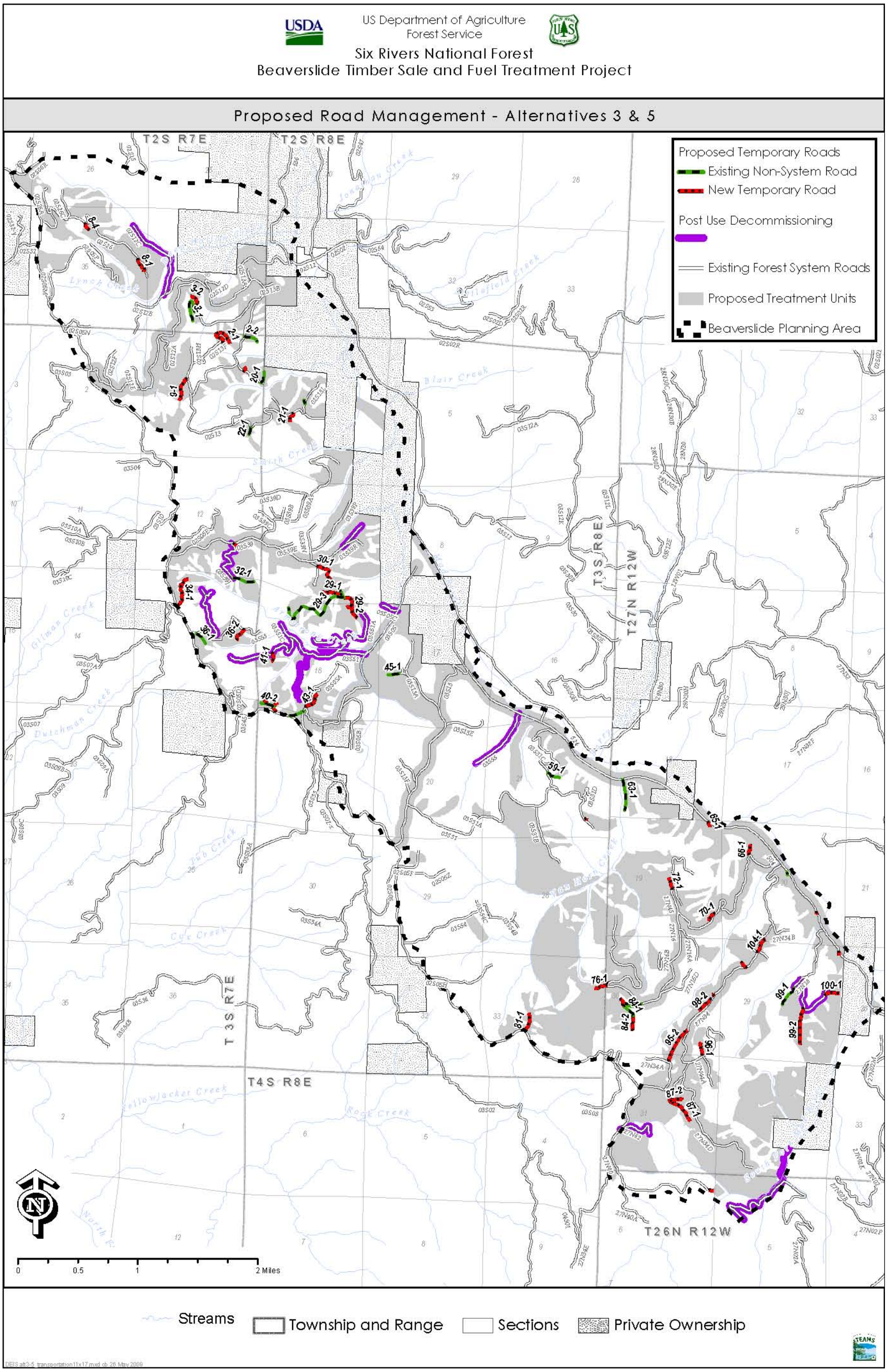
Map 2. Proposed commercial thinning units and logging systems in Alternative 4



Map 3. Proposed commercial thinning units and logging systems in Alternative 5



Map 4. Proposed fuel treatment areas and fuel treatment types in Alternatives 3, 4 and 5



Map 5. Proposed road management actions in Alternatives 3 and 5